



**WILD ADULT STEELHEAD AND CHINOOK SALMON
ABUNDANCE AND COMPOSITION AT
LOWER GRANITE DAM,
SPAWN YEAR 2010**

2010 ANNUAL REPORT



Photo: Scott Putnam

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2010 Annual Report

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ABBREVIATIONS AND ACRONYMS

BPA	Bonneville Power Administration
BY	Brood Year
CI	Confidence Interval
COE	U. S. Army Corps of Engineers
CWT	Coded Wire Tag
DPS	Distinct Population Segment
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
F	Female
FL	Fork Length
GSI	Genetic Stock Identification
IA	Individual Assignment
ICBTRT	Interior Columbia Basin Technical Recovery Team
IDFG	Idaho Department of Fish and Game
IOSC	Idaho Office of Species Conservation
ISEMP	Integrated Status and Effectiveness Monitoring Project
LGD	Lower Granite Dam
LSRCP	Lower Snake River Compensation Plan
M	Male
MCMC	Markov Chain Monte Carlo
MM	Mixture Modeling
MPG	Major Population Group
MSA	Mixed Stock Analysis
NMFS	National Marine Fisheries Service
PBT	Parentage Based Tagging
PIT	Passive Integrated Transponder
PSMFC	Pacific States Marine Fisheries Commission
QCI	Quantitative Consultants, Inc.
SNP	Single Nucleotide Polymorphism
SY	Spawn Year
TAC	Technical Advisory Committee, <i>U.S. v. Oregon</i>
VSP	Viable Salmonid Population
WDFW	Washington Department of Fish and Wildlife

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ABSTRACT

This report summarizes the abundance and composition of wild adult steelhead and spring-summer Chinook salmon returning to Lower Granite Dam in spawn year 2010. We used a combination of window counts and systematic biological samples from the adult fish trap to decompose each run by origin, body size (steelhead only), age, gender, and stock. For steelhead between July 1, 2009 and June 30, 2010, wild escapement was estimated to be 42,773 fish or 13.2% of the total run. Of these, 735 fish were from brood year (BY) 2007; 14,693 fish from BY2006; 18,509 fish from BY2005; 7,198 fish from BY2004; 1,590 fish from BY2003; and 48 fish from BY2002. Total age at spawning ranged from three to eight years; freshwater age ranged from one to five years and saltwater age ranged from one to three years. Using a sex-specific genetic assay, we estimate 26,403 females and 16,370 males returned. Genetic stock abundance estimates were 7,789 fish for the upper Salmon River; 4,513 fish for the Middle Fork Salmon River; 1,519 fish for the South Fork Salmon River; 1,454 fish for the lower Salmon River; 2,848 fish for the upper Clearwater River; 3,235 fish for the South Fork Clearwater River; 1,660 fish for the lower Clearwater River; 2,950 fish for the Imnaha River; 6,917 fish for the Grande Ronde River; and 9,888 fish for the lower Snake River. The combined wild and hatchery steelhead escapement was 323,382 fish counted at the window by U.S. Army Corps of Engineers. We estimate that 280,609 of these fish were of hatchery origin, of which 11.8% were unclipped. For Chinook salmon between March 1 and August 17, 2010, wild escapement was estimated to be 27,664 fish or 20.5% of the total run. Of these, 48 fish were from BY2008; 1,274 fish from BY2007; 24,395 fish from BY2006; and 1,947 fish from BY2005. Total age at spawning ranged from two to five years; freshwater age ranged from zero to two years and saltwater age ranged from zero (mini-jack) to three years. Using a sex-specific genetic assay, we estimate 12,135 females and 15,529 males returned. Genetic stock abundance estimates were 4,649 fish for the upper Salmon River; 4,527 fish for the Middle Fork Salmon River; 1,154 fish for Chamberlain Creek; 7,718 fish for the South Fork Salmon River; 8,790 fish for the Hells Canyon aggregate stock including the Clearwater, lower Salmon, Grande Ronde, and Imnaha rivers; and 50 fish for the Lower Snake (Tucannon) River. In addition, 776 fish or 2.8% of the wild run were identified as fall Chinook salmon based on genetic data. The combined wild and hatchery Chinook salmon escapement was 134,684 fish counted at the window by U.S. Army Corps of Engineers. We estimate that 107,020 of these fish were of hatchery origin, of which 6.5% were unclipped. In the future, estimates of wild adult abundance and composition for these two species will be combined with similar information for smolts from the Lower Granite Dam juvenile facility. This will enable us to estimate productivity and other viable salmonid population parameters.

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INTRODUCTION

Populations of steelhead trout *Oncorhynchus mykiss* and Chinook salmon *O. tshawytscha* in the Snake River basin declined substantially following the construction of hydroelectric dams in the Snake and Columbia rivers. Raymond (1988) documented a decrease in survival of emigrating steelhead trout and Chinook salmon from the Snake River following the construction of dams on the lower Snake River during the late 1960s and early 1970s. Abundance rebounded slightly in the early 1980s, but then escapements over Lower Granite Dam into the Snake River basin declined again (Busby et al. 1996). In recent years, abundances in the Snake River basin have slightly increased. The increase has been dominated by hatchery fish, while the returns of naturally produced steelhead trout and Chinook salmon remain critically low. As a result, Snake River steelhead trout (hereafter steelhead) were classified as threatened under the Endangered Species Act (ESA) in 1997. Within the Snake River steelhead distinct population segment (DPS), there are six major population groups: Lower Snake River, Grande Ronde River, Imnaha River, Clearwater River, Salmon River, and Hells Canyon Tributaries (Table 1; ICBTRT 2003, 2005; NMFS 2011). However, the Hells Canyon major population group is considered to be extirpated. A total of 24 extant demographically independent populations have been identified. Snake River spring-summer Chinook salmon (hereafter Chinook salmon) were classified as threatened in 1992 under the ESA. Within the Snake River spring-summer Chinook salmon evolutionarily significant unit (ESU), there are seven major population groups: Lower Snake River, Grande Ronde/Imnaha Rivers, South Fork Salmon River, Middle Fork Salmon River, Upper Salmon River, Dry Clearwater, and Wet Clearwater. However, the Dry Clearwater and Wet Clearwater major population groups are considered to be extirpated. A total of 29 extant demographically independent populations have been identified.

Anadromous fish management programs in the Snake River basin include large-scale hatchery programs – intended to mitigate for the impacts of hydroelectric dam construction and operation in the basin – and recovery planning and implementation efforts aimed at recovering ESA-listed wild steelhead and salmon stocks. The Idaho Department of Fish and Game's long-range goal of its anadromous fish program, consistent with basinwide mitigation and recovery programs, is to preserve Idaho's salmon and steelhead runs and recover them to provide benefit to all users (IDFG 2007). Management to achieve these goals requires an understanding of how salmonid populations function (McElhany et al. 2000) as well as regular status assessments. However, specific data on Snake River steelhead and Chinook salmon populations are lacking, particularly key parameters such as population abundance, age composition, genetic diversity, recruits per spawner, and survival rates (ICBTRT 2003). The key metrics to assessing viability of salmonid populations are abundance, productivity, spatial structure and diversity (McElhany et al. 2000).

The aggregate escapement of Snake River steelhead and Chinook salmon is measured at Lower Granite Dam (LGD), with the exception of the Tucannon River, Washington, population. Some of the wild fish are headed to Washington or Oregon tributaries to spawn, but the majority is destined for Idaho. Age, sex, and stock composition data are important for monitoring recovery of wild fish for both species. Age data collected at LGD are used to assign returning adults to specific brood years, for cohort analysis, and to estimate productivity and survival rates (Copeland et al. 2007; Copeland and Putnam 2009; Copeland et al. 2009; Copeland and Roberts 2010; Copeland et al. 2011; Kennedy et al. 2011; Schrader et al. 2011). In addition, escapement estimates by cohort are used to forecast run sizes in subsequent years, and these forecasts are the basis for preliminary fisheries management plans in the Columbia River basin.

At Columbia River dams, U.S. Army Corps of Engineers (COE) designates jack Chinook salmon as fish between 30 and 56 cm (12 and 22 inches) in length, and salmonids under 30 cm (12 inches) in length are not identified to species. Mini-jacks are precocious fish generally under 30 cm in length and thus are not counted (Steve Richards, WDFW, personal communication). Throughout this report, unless otherwise stated, adult Chinook salmon refers to reproductively mature fish returning to spawn, including jacks but excluding mini-jacks less than 30 cm. For Chinook salmon, the run year at LGD is defined to be from March 1 to June 17 for the spring run, and from June 18 to August 17 for the summer run. For steelhead, the run year at LGD is defined to be from July 1 to June 30. The steelhead run year dates were chosen to be consistent with the upriver steelhead run year at Bonneville Dam as defined in the *U.S. v. Oregon* management agreement.

This report summarizes the abundance and composition of wild adult steelhead and Chinook salmon returning to LGD during spawn year (SY) 2010. For steelhead, fish passing LGD during the summer and fall of 2009 comprise the bulk of the 2010 spawn year. There is one previous preliminary accounting of the data: Ackerman et al. (2012) reported initial genetic stock identification (GSI) results for both steelhead and Chinook salmon based on single nucleotide polymorphism (SNP) variation. Here we develop those analyses further and this report supersedes the earlier work. Because of the collaborative nature of the work at LGD, this report is a product of several Bonneville Power Administration (BPA) projects: Idaho Steelhead Monitoring and Evaluation Studies (1990-055-00), Idaho Natural Production Monitoring and Evaluation Program (1991-073-00), and Chinook and Steelhead Genotyping for Genetic Stock Identification at Lower Granite Dam (2010-026-00).

METHODS

Adult Trap Operations at Lower Granite Dam

Systematic samples of steelhead and Chinook salmon returning to LGD were collected during daily operation of the adult fish trap by National Marine Fisheries Service (NMFS; BPA project 2005-002-00, Lower Granite Dam Adult Trap Operations; Harmon 2003; Ogden 2010, 2011). The adult trap is located in the LGD fish ladder upstream from the fish counting window. The trap captures a systematic random sample of fish by operating a trap gate according to a predetermined sample rate. The sample rate determines how long the trap gate remains open four times per hour; the trap is operational 24 hours per day. Additional details on the adult trap can be found in Harmon (2003) and Steinhorst et al. (2010). During 2009, the trap sample rate changed three times and ranged from 5% in early July to 12% in late August and early September (Table 2). The trap was closed from July 21 to August 17, 2009 and from September 2 to 5, 2009 due to high water temperatures. It was closed from November 16, 2009 to February 28, 2010 due to freezing water temperatures. During 2010, the trap sample rate started at 15% on March 1 and switched to 4% on April 18. The trap was closed from August 14 to August 17, 2010 due to high water temperatures. The adult fish ladder was dewatered from January 4 to February 2, 2010; hence, there was no adult passage during this time period except through the navigation lock.

Standard methods were used by NMFS or Idaho Department of Fish and Game (IDFG) staff to process and biologically sample adult fish (Harmon 2003; Ogden 2010, 2011; Appendix A). All adult fish captured were anesthetized; examined for external marks, tags, and injuries; scanned for an internal coded wire tag (CWT) or passive integrated transponder (PIT) tag; and

measured for fork length (FL, nearest cm). All fish were classified by origin (wild or hatchery) and the presence (hereafter unclipped) or absence (hereafter clipped) of the adipose fin. Wild fish have an unclipped adipose fin because they spend their entire life cycle in the natural environment. Although most hatchery origin steelhead and Chinook salmon have a clipped adipose fin, some are released with an unclipped adipose fin for supplementation purposes. For unclipped steelhead, hatchery origin was determined primarily by the presence of dorsal or ventral fin erosion, which is assumed to occur only in hatchery-reared fish (Latremouille 2003). We also used the presence of a CWT or ventral fin clip to determine if an unclipped fish was of hatchery origin. For unclipped Chinook salmon, hatchery origin was determined solely by the presence of a CWT or ventral fin clip. Captured fish determined to be wild were sampled for scales and tissue. New for SY2010, and starting August 18, 2009, all captured fish determined to be wild were also PIT tagged for the Integrated Status and Effectiveness Monitoring Project (ISEMP, BPA project 2003-017-00; Beasley and White 2010; QCI 2011).

Scale samples were taken from above the lateral line and posterior to the dorsal fin. Samples were stored in coin envelopes for transport to the IDFG aging laboratory in Nampa, Idaho. Tissue samples were taken from a small clip of the anal fin. Tissues were stored in a vial with 200-proof nondenatured ethyl alcohol for transport to the IDFG genetics laboratory in Eagle, Idaho.

After processing, all fish were returned to the adult fish ladder to resume their upstream migration. No trap mortalities for either species were observed during SY2010 (Ogden 2010, 2011).

Valid Sample Selection

Not all trapped fish were deemed valid for sample selection or analysis. Trapped fish that were missing data entry records for any of the following five fields were considered invalid: date of collection, species, fork length, origin (hatchery or wild), or adipose fin status (clipped or unclipped). Trapped fish less than 30 cm (FL) were considered invalid as they are not identified to species at the COE fish-counting window. Further, the adult trap was not designed to efficiently trap these smaller fish (Darren Ogden, NMFS, personal communication); for Chinook salmon this includes all mini-jacks less than 30 cm. Finally, any sort-by-code PIT-tagged fish trapped outside the normal trap sampling timeframe were considered invalid. A computer program written by Doug Marsh (NMFS) was used to make this determination. Sort-by-code, or separation-by-code, is the process whereby PIT-tagged fish ascending the LGD fish ladder are diverted into the trap box using predetermined tag codes programmed into the trap gate computer. For SY2010, there were six trapped steelhead that were considered invalid – one was less than 30 cm (FL) and five were missing data entry fields. There were forty-eight trapped Chinook salmon that were considered invalid by these criteria – twenty-two were hatchery mini-jacks less than 30 cm (FL); nineteen were wild sort-by-code fish for the Lemhi River radio telemetry project (Bowersox and Biggs 2011); five were hatchery sort-by-code fish for the Lower Columbia River sonic tagging project (Rub et al. 2012); and two were missing data entry fields.

Our goal was to age and genotype approximately 2,000 wild steelhead and 2,000 wild Chinook salmon. New for SY2010, and in collaboration with our work, the ISEMP goal was to PIT tag and collect scale and genetics tissue samples from 4,000 wild steelhead and 4,000 wild Chinook salmon. We emphasize that IDFG and ISEMP sample goals were complimentary and not mutually exclusive. To achieve the IDFG goal, all trap samples were systematically subsampled if more than 2,000 samples were available for each species. The result was a pool of samples collected systematically across the spawning run of each species and generally in

constant proportion to their abundance. Hence, for either species, the sample pool can be considered a simple random sample (Kirk Steinhorst, University of Idaho, personal communication).

Scale Processing and Analysis

Technicians processed scale samples in the IDFG aging laboratory. Scales were examined for regeneration and 6-10 nonregenerated scales were cleaned and mounted between two glass microscope slides. Scales were examined on a computer video monitor using a Leica DM4000B microscope and a Leica DC500 digital camera. A technician chose the best scales for aging and saved them as digitized images. The entire scale was imaged using 12.5x magnification. In addition, the freshwater portion was imaged using 40x magnification. Two technicians independently viewed each image to assign ages without reference to fish length. If there was no age consensus among the readers, a third reader viewed the image and all readers collectively examined the image to resolve their differences before a final age was assigned. If a consensus age was not attained, the sample was excluded from further analysis.

Freshwater annuli were defined by pinching or cutting-over of circuli within the freshwater zone in the center of the scale. The criterion for a saltwater annulus was the crowding of circuli after the rapid saltwater growth had begun. We used only visible annuli formed on the scales, excluding time spent overwintering in fresh water prior to spawning. New for steelhead in SY2010, we identified repeat spawners by the presence of a spawn check. A spawn check appears as a ragged scar mark within the saltwater zone. Spawn checks are caused by resorption of circuli that occurs during their return to freshwater for spawning (Davis and Light 1985). After resorption occurs in freshwater, and when the fish returns to saltwater and scale growth resumes, a spawn check is formed (White and Medcof 1968). New for Chinook salmon in SY2010, we identified ocean age-0 mini-jacks. Mini-jacks exhibit rapid saltwater growth after entering the ocean but lack a saltwater annulus (Johnson et al., *In Press*). Mini-jacks return to freshwater within the same year and stay in the ocean only three to five months. We use the European system to designate ages; freshwater age is separated from saltwater age by a decimal. For steelhead repeat spawners, an 'S' is added to the saltwater age to designate the winter spent in freshwater while on a spawning run. Brood year, or total age at spawning, is the sum of freshwater and saltwater ages, plus 1. Fish lacking either a freshwater or saltwater determined age were not used for analysis.

Known ocean-age fish that were PIT tagged as juveniles were used for saltwater age validation. We currently do not have any validation methods for wild fish freshwater ages. Accuracy of age assignments was estimated by percent agreement between saltwater age and known emigration date, determined from juvenile PIT tag detection in the hydrosystem. Known ocean-age hatchery and wild fish were used to compute accuracy rate for Chinook salmon ages; only known ocean-age wild fish were used to compute accuracy rate for steelhead ages. The mean coefficient of variation was used to measure aging precision between primary readers (formula from Chang 1982; see Copeland et al. 2007).

Genetics Tissue Processing and Analysis

Detailed methods for genomic DNA extraction and amplification and SNP genotyping are described in Ackerman et al. (2012). Briefly, genomic DNA was extracted and then "pre-ampped" to jumpstart SNP amplification via increased copy number of target DNA regions. For steelhead, all individuals were genotyped at 191 SNPs (including three SNPs that identify potential *O. mykiss* x *O. clarkii* hybrids) and a Y-specific assay that differentiates sex in *O. mykiss*. For

Chinook salmon, all individuals were genotyped at 95 SNPs (including one mitochondrial DNA SNP) and a Y-specific allelic discrimination assay that differentiates sex in *O. tshawytscha*. SNP amplification was performed using Fluidigm 96.96 Dynamic Array IFCs (chips). Chips were imaged on a Fluidigm EP1™ system and analyzed and scored using the Fluidigm SNP Genotyping Analysis Software. Samples were processed at either the IDFG genetics laboratory in Eagle, Idaho, or the Columbia River Inter-Tribal Fish Commission's genetics laboratory in Hagerman, Idaho (BPA project 2010-026-00).

Two types of genetic classification techniques are generally used for mixed stock analyses (MSA) and both use allele frequencies from baseline populations as reference information to characterize potentially contributing stocks. Individual assignment (IA) methods assign each individual to the stock in which the probability of its genotype occurring is the greatest. The proportion of a particular stock can then be estimated by summing all of the individual assignments to that stock and dividing by the total sample size. In contrast, mixture modeling (MM) does not assign each individual to one specific stock. Instead, MM uses likelihood or Bayesian modeling methods to fractionally allocate individual samples within the mixture to each stock in proportion to the probability that it belongs to that stock. Mixture modeling methods have been shown to be more accurate for estimating stock composition when all individual assignments cannot be made with high confidence (Manel et al. 2005, Koljonen et al. 2005). Because we are interested in estimating both stock proportions and abundance of the wild escapement as a whole, as well as estimating sex and age proportions using biological data from fish returning to individual stocks, we used a combination of both MM and IA for genetic stock reconstruction at Lower Granite Dam. For both MSA procedures, fish were initially sampled from discrete "reference" populations (i.e. wild Snake River spawning aggregations) that potentially contribute to the aggregation of mixed populations (i.e. aggregate wild escapement at LGD) and genotyped to establish a genetic baseline. Fish captured at LGD were then genotyped and assigned wholly (IA) or fractionally (MM) back to their reporting group of origin (Pella and Milner 1987, Shaklee et al. 1999). Ackerman et al. (2012) provide a detailed description of the Snake River genetic baselines used for both steelhead and Chinook salmon (also see Appendix B). Snake River reporting groups used for both MM and IA at LGD were defined by Ackerman et al. (2012). Reporting groups are assemblages of reference (baseline) populations grouped primarily by genetic and geographic similarities and secondarily by political boundaries and management units (Ackerman et al. 2011).

Mixture modeling using multilocus genotype data was performed to estimate stock proportions of the wild escapement at LGD. Stock proportions are then multiplied by our estimated total wild escapement at Lower Granite Dam to estimate abundance for each stock. Mixture modeling of individuals genotyped from the LGD adult fish trap was done using the Bayesian version of the program *gsi_sim* (Anderson et al. 2008, Anderson 2010). The Bayesian version of *gsi_sim* uses Markov chain Monte Carlo (MCMC) to computer posterior probabilities of stock membership conditional on the allele frequencies estimated from the baseline. The likelihood that a fish originates from a stock is computed using the compound Dirichlet-multinomial formulation of Rannala and Mountain (1997) conditional on the baseline samples and these likelihoods remain fixed throughout the MCMC simulation. To perform the MCMC, *gsi_sim* uses a Gibbs sampler (Casella and George 1992) in which alternately: 1) the stock assignments of the fish in the mixture are updated as a multinomial draw from their posterior probabilities given the current estimate of the stock proportions and the stock-likelihoods of the fish; and 2) the stock proportions are updated as a draw from a Dirichlet distribution given a unit-information prior and the current values of the stock assignments of all the fish in the mixture. By sampling the current values of the stock proportions as the chain proceeds, a Monte Carlo estimator of the posterior mean and any desired quantiles can be computed. For

estimating stock proportions, we ran 300,000 MCMC sweeps with a burn-in of 50,000 sweeps and a thinning interval of 50 to obtain 5,000 Bayesian posterior estimates of stock proportions for each stock. The 5,000 Bayesian posterior estimates of stock proportions were used for subsequent calculation of confidence intervals (CI) for stock proportions. The maximum likelihood estimates of stock proportions were used to calculate stock abundances.

To estimate sex and age proportions within each stock, genotyped individuals were assigned to their “best-estimate” reporting group-of-origin using *gsi_sim*. The IA option in *gsi_sim* determines the “best-estimate” stock of origin based on the reporting group with the highest probability of assignment for a particular fish. Because the accuracy of assignment declines with decreased assignment probabilities, only individuals with $\geq 80\%$ probability of assignment to a particular stock were considered assigned and used to calculate stock-by-sex-by-age proportions.

The resolution of the Snake River genetic baselines to perform both MM and IA are evaluated fully in Ackerman et al. (2012); those methods and results are briefly described in this report. To evaluate the resolution of the baselines for MM, Ackerman et al. (2012) performed 100% simulations using the program ONCOR (Kalinowski et al. 2007). An analysis was run for each Snake River population represented in the baseline in which both baseline and mixture genotypes were randomly generated using estimated baseline allele frequencies (Anderson et al. 2008). The simulated mixture (containing entirely individuals simulated from the population being tested) was then proportionally assigned back to the resampled baseline. The proportion of the simulated mixture that assigned back to correct or incorrect reporting groups was calculated.

To evaluate the resolution of the baselines for IA, Ackerman et al. (2012) performed self-assignment tests in the program *gsi_sim*. Each individual from the baseline (which represents a fish of ‘known origin’) is removed sequentially and the reporting group of origin of that individual is then estimated. For each baseline population, we calculated the proportion of individuals that assigned to a reporting group with $\geq 80\%$ probability; and of those, the proportion of assigned individuals that assigned to their reporting group of origin.

Starting in SY2010, ISEMP (BPA project 2003-017-00) began PIT tagging all wild steelhead and Chinook salmon sampled at the LGD adult trap with the goal of estimating escapement into tributaries with PIT-tag arrays (Beasley and White 2010; QCI 2011, 2012). For SY2010, we received from ISEMP personnel a list of adults that were PIT tagged at Lower Granite Dam and were later detected at tributary PIT-tag arrays or hatchery traps including $n = 245$ steelhead and $n = 350$ Chinook salmon. Of these samples, 134 steelhead and 79 Chinook salmon were genotyped using the full complement of SNPs used for GSI to evaluate concordance between tributary PIT-tag array or hatchery trap detection locations and the estimated genetic origin of these adults using IA. Only fish that assigned with $\geq 80\%$ probability using IA were considered genetically assigned.

Steele et al. (2012) estimated accuracy of our sex-specific genetic assays. Gender was not and generally cannot be reliably determined at the LGD adult trap; thus, a direct comparison was not attempted. Campbell et al. (2012) and references therein describe in more detail the methods of sex-determination using genetic assays.

Escapement by Origin, Size, Age, Sex, and Stock

The COE daily window counts, which occur in the fish ladder downstream of the adult trap, were assumed to be the daily aggregate escapement to LGD for each species. Video counts were used by COE in lieu of window counts in November, December, and March (Table 2). Window count times were 0400-2000, whereas video count times were 0600-1600 Pacific Time. Count data were downloaded from the COE website (<http://www.nwp.usace.army.mil/environment/fishdata.asp>.) Additional daily window and video operation information was obtained from COE annual fish passage reports (COE 2009, 2010). For Chinook salmon, the adult count was combined with the jack count to derive the total count on a daily basis.

To estimate escapement by origin or size, the daily window or video counts were combined with adult trap sample data on a statistical week basis to account for changes in the trapping rate and run characteristics through time. Statistical weeks started on Monday and ended on Sunday. If necessary, weeks were grouped to try to provide a minimum sample size of 100 trapped fish. In some time strata, we opted not to combine if adjacent strata were above the minimum or if there was a gap in sampling (e.g., summer sampling for steelhead). For steelhead, weekly proportions of wild, clipped hatchery, and unclipped hatchery fish were estimated for large fish (≥ 78 cm, FL) and small fish (< 78 cm, FL) using the trap data. These size criteria are used to inform management processes, particularly under the Technical Advisory Committee (TAC), *U.S. vs. Oregon*. For Chinook salmon, weekly proportions were estimated for wild, clipped hatchery, and unclipped hatchery fish irrespective of size. For both species, weekly escapement was estimated by multiplying the weekly window or video counts by the weekly trap proportions; the sum of the weekly escapement estimates was the total escapement to LGD by origin or size. In essence, the weekly proportions for origin (and size) are weighted by weekly run size of all fish as counted at the window or by video.

To estimate wild escapement by age, sex, or stock, the total wild escapement estimate was multiplied by the overall age, sex, or stock proportions from the trap biological samples of wild fish. Stock proportions were estimated based on MM using multi-locus genotype data. Because we systematically subsampled all wild fish trapped at LGD, and because this sample pool can be considered a simple random sample selected in proportion to abundance, time stratification was not necessary for the age, sex, or stock abundance point estimates (Kirk Steinhorst, University of Idaho, personal communication).

Confidence intervals for all point estimates were computed using a bootstrapping algorithm (Manly 1997). For origin – wild versus hatchery – the variation in trap sampling is accounted for by taking bootstrap samples of the trap data by week. This bootstrap proportion is then multiplied by the total weekly window count and summed to produce 5000 bootstrap values for number wild (or hatchery). The 95% confidence intervals were found by finding the 2.5th and 97.5th percentiles of the 5,000 ordered bootstrap values for each group.

When estimating abundance by age and by sex, there is additional variability due to scale (or genetics tissue) sampling. The scale (or genetics) database was sampled with replacement 5000 times. This generates 5000 bootstrap proportions for age (or sex). Multiplying the 5000 bootstrap wild (or hatchery) estimates by the 5000 bootstrap proportions for age (or sex) gives 5000 bootstrap wild (or hatchery) estimates by age (or sex). The one-at-a-time 95% confidence intervals were found by finding the 2.5th and 97.5th percentiles of the 5,000 ordered bootstrap values for each group. Simultaneous confidence intervals for the number of wild fish of different ages or sex were found by expanding the hypercube formed from the one-at-a-time

bootstrap confidence intervals 0.5% in each dimension until 95% of all the bootstrap points were within the expanded hypercube. Separate bootstraps were performed for each grouping within a parameter (e.g., total age, ocean age, and brood year were separate runs of the age data). Confidence intervals for the origin group (e.g., wild versus hatchery) were determined from the vector of bootstrap abundances output after the first level of the bootstrapping routine was finished. The algorithm was written and implemented in the R programming environment (R Development Core Team 2008) by Kirk Steinhorst (University of Idaho).

Variance in the wild fish escapement estimate was incorporated into variance in the genetic stock proportion estimates using a combination of bootstrapping (variance in wild fish escapement) and Monte Carlo methods (variance in stock proportions). The bootstrapping algorithm outlined above was used to create a vector of 5,000 bootstrap estimates of total wild escapement. The MCMC method implemented in *gsi_sim* was used to generate a vector of 5,000 Bayesian posterior estimates of stock proportion for each genetic stock. The bootstrap estimates of total wild escapement were then multiplied through the Bayesian posterior estimates of stock proportions for each genetic stock to obtain a vector of stock abundance. The one-at-a-time bootstrap intervals of stock abundance were found via the 2.5th and 97.5th percentiles of the 5,000 ordered “bootstrap” values for each group. Similar to age and sex calculations, simultaneous confidence intervals for each genetic stock’s abundance were found by expanding the hypercube formed from the one-at-a-time bootstrap confidence intervals 0.5% in each dimension until 95% of all the bootstrap points were within the expanded hypercube.

New for SY2010, ten wild steelhead reporting groups were used during MM and IA analyses (Appendix Table B-1). The reporting groups include: 1) UPSALM: upper Salmon River (including North Fork Salmon River and upstream); 2) MFSALM: Middle Fork Salmon River (including Chamberlain and Bargamin creeks); 3) SFSALM: South Fork Salmon River; 4) LOSALM: Little Salmon River and tributaries of the lower Salmon River; 5) UPCLWR: upper Clearwater River (Lochsa and Selway rivers); 6) SFCLWR: South Fork Clearwater River (including Clear Creek); 7) LOCLWR: lower Clearwater River (primarily Potlatch River); 8) IMNAHA: Imnaha River; 9) GRROND: Grande Ronde River; and 10) LSNAKE: tributaries of the lower Snake River both above (Alpowa and Asotin creeks) and below (primarily Tucannon River) LGD. Fish that originated below LGD ascend the dam and either stay upriver to spawn or fall back and spawn downriver. Results from some reporting groups are also aggregated to report by Snake River steelhead major population groups (MPGs; Table 1).

New for SY2010, seven wild Chinook salmon reporting groups were used during MM and IA analyses (Appendix Table B-2). The reporting groups include: 1) UPSALM: upper Salmon River (Lemhi River and upstream); 2) MFSALM: Middle Fork Salmon River; 3) CHMBLN: Chamberlain Creek; 4) SFSALM: South Fork Salmon River; 5) HELLSC: Hells Canyon stock, an aggregate reporting group that includes the Clearwater, lower Salmon, Grande Ronde, and Imnaha rivers; 6) TUCANO: Lower Snake (Tucannon) River, and 7) FALL: Snake River fall Chinook salmon. Except for fall Chinook salmon, these reporting groups correspond to Snake River spring-summer Chinook salmon individual or combined MPGs (Table 1). The TUCANO reporting group was included in the baseline to represent fish that originated below LGD but ascend the dam and either stay upriver to spawn or fall back and spawn downriver. Three collections of Snake River fall Chinook salmon (Clearwater River, Nez Perce Tribal Hatchery, and Lyons Ferry Hatchery) were added to the baseline (Ackerman et al. 2012); our purpose was to distinguish fall Chinook salmon from spring-summer Chinook salmon trapped prior to August 17 using genetic data.

Wild Stock Escapement by Sex and Age

After estimating the wild escapements by stock using MM, we used results from IA analyses to decompose the stock escapements by sex and age. As the accuracy of assignment declines with decreased assignment probabilities, only individuals that assigned with $\geq 80\%$ probability to a particular reporting group were used to calculate stock-by-sex-by-age proportions. Calculated proportions from fish that assigned with $\geq 80\%$ probability were then applied to the estimated stock escapements to obtain abundance for stock-by-sex-by-age.

RESULTS

Steelhead Escapement

For SY2010 – from July 1, 2009 to June 30, 2010 – a total of 323,382 wild and hatchery steelhead were counted at the LGD window or by video (Figure 1; Appendix Table C-1). The first fish was counted on July 1, 2009, and the last fish was counted on June 30, 2010. Of the total escapement, there were 5,872 fish or 1.8% of the run that passed during the July 21 to August 17, 2009 trap closure. Another 7,497 fish or 2.3% of the run passed during the September 2-5, 2009 trap closure. And another 3,510 fish or 1.1% of the run passed during the November 16, 2009 to February 28, 2010 trap closure. The trap was operational during 94.8% of the run.

At the adult trap, a total of 31,322 wild and hatchery steelhead were captured and considered valid (Appendix Table C-1). Of these, 29,704 fish or 94.8% were trapped during fall 2009, and 1,618 fish or 5.2% were trapped during spring 2010. The adult trap sampled 9.7% of the window count overall (weekly range 2.9-22.1%).

Of the steelhead trapped, there were 423 large (≥ 78 cm, FL) wild fish; 1,629 large hatchery clipped fish; 282 large hatchery unclipped fish; 3,620 small (< 78 cm, FL) wild fish; 22,361 small hatchery clipped fish; and 3,007 small hatchery unclipped fish (Appendix Table C-2). Combining large and small fish, a total of 7,332 unclipped and 23,990 clipped fish were trapped.

We estimate that 1.3% of the run was large wild; 5.0% was large hatchery clipped; 0.8% was large hatchery unclipped; 11.9% was small wild; 71.5% was small hatchery clipped; and 9.4% was small hatchery unclipped (Appendix Table C-3). Of all returning unclipped fish, we estimate 43.7% were of hatchery origin based primarily on visual identification at the trap. Of all returning hatchery fish, we estimate 11.8% were unclipped. We estimate that 18.6% of all large fish were wild compared to 12.8% of all small fish. Overall, 13.2% of the run was wild and 86.8% was of hatchery origin. However, the percentage of wild was not constant throughout the run. No wild fish were trapped in July 2009, and roughly a fourth of the trapped fish were wild in August 2009. The percentage of wild fish declined through the fall to as low as 11.2% and then began climbing as winter approached. The lowest percentage was 8.2% in early March 2010.

Of the total steelhead escapement to LGD, we estimate that 4,330 fish (95% CI 3,926-4,758) were large wild; 16,309 fish (95% CI 15,545-17,098) were large hatchery clipped; 2,634 fish (95% CI 2,321-2,964) were large hatchery unclipped; 38,443 fish (95% CI 37,224-39,663) were small wild; 231,167 fish (95% CI 229,507-232,851) were small hatchery clipped; and 30,499 fish (95% CI 29,404-31,628) were small hatchery unclipped (Figure 2; Appendix Table C-4). Overall, 42,773 wild (95% CI 41,467-44,089) and 280,609 hatchery (95% CI 279,318-

281,883) steelhead returned to LGD after combining large, small, clipped, and unclipped fish (Figure 3). Our total estimate of 75,906 unclipped fish, wild and hatchery combined, is 98.5% of the COE reported window count of 77,066 unclipped fish.

Wild Steelhead Age, Sex, and Stock Composition

Of the 4,043 wild steelhead scale and genetics samples collected at the trap, we systematically subsampled 1,926 for aging and genotyping (Appendix Table C-5). The first sample was collected on August 18, 2009, and the last was collected on May 17, 2010. We were able to assign total age to 1,747 samples or 4.1% of the estimated run size (weekly range 1.8-4.8%). We were able to assign gender to 1,829 samples or 4.3% of the run size (weekly range 1.9-5.1%). We were able to obtain complete genotype data ($\geq 90\%$ of SNPs amplify successfully) for 1,915 samples or 4.5% of the run size (weekly range 1.9-5.2%).

We observed 18 different age classes from the 1,747 fish that we were able to assign a total age (Appendix Table C-6). Total age at spawning ranged from three to eight years, with freshwater age ranging from one to five years and saltwater age ranging from one to three years. We estimate that 1.7% of the wild return was from brood year (BY) 2007; 34.3% from BY2006; 43.4% from BY2005; 16.9% from BY2004; 3.8% from BY2003; and 0.2% from BY2002 (Appendix Table C-7). Less than 1.0% of the return was repeat spawners, and no more than one spawn check for each fish was observed.

Estimated escapement to LGD by age class was 735 fish for age 1.1 (95% CI 367-1,337); 783 fish for age 1.2 (95% CI 393-1,408); 13,910 fish for age 2.1 (95% CI 9,616-19,973); 24 fish for age 1.3 (95% CI 0-100); 9,524 fish for age 2.2 (95% CI 6,491-13,906); 8,937 fish for age 3.1 (95% CI 6,034-13,082); 24 fish for age 2.1S (95% CI 0-100); 441 fish for age 2.3 (95% CI 184-865); 5,411 fish for age 3.2 (95% CI 3,557-8,166); 1,273 fish for age 4.1 (95% CI 713-2,177); 73 fish for age 2.1S1 (95% CI 0-227); 392 fish for age 3.3 (95% CI 163-800); 930 fish for age 4.2 (95% CI 480-1,656); 73 fish for age 5.1 (95% CI 0-227); 171 fish for age 3.1S1 (95% CI 37-401); 24 fish for age 3.2S (95% CI 0-100); 24 fish for age 4.3 (95% CI 0-100); and 24 fish for age 4.1S1 (95% CI 0-100; Figure 4). Estimated escapement to LGD by saltwater age was 24,928 one-saltwater fish (95% CI 21,784-28,551); 16,648 two-saltwater fish (95% CI 14,307-19,311); 881 three-saltwater fish (95% CI 556-1,284); and 316 fish that were repeat spawners (95% CI 152-551). Estimated escapement to LGD by total age at spawning was 735 fish from BY2007 (95% CI 451-1,074); 14,693 fish from BY2006 (95% CI 12,711-16,899); 18,509 fish from BY2005 (95% CI 16,210-21,061); 7,198 fish from BY2004 (95% CI 6,007-8,573); 1,590 fish from BY2003 (95% CI 1,133-2,122); and 48 fish from BY2002 (95% CI 0-133; Figure 5).

Of the 1,829 fish that gender was successfully determined using the sex-specific assay, 1,129 were female and 700 were male (Appendix Table C-8). The gender percentages for the entire run were 61.7% female and 38.3% male (Appendix Table C-9). The sex ratio was female-biased throughout the run except November and December 2009 and ranged from 49.3 to 68.3%. Expanding the overall percentages to the wild run gives 26,403 females (95% CI 24,760-28,044) and 16,370 males (95% CI 15,124-17,727; Figure 6). We estimate that 48.6% of the females and 73.7% of the males were one-saltwater, and that 1.0% of the females and 0.3% of the males were repeat spawners.

Based on MM results using the 1,915 fish with complete genotypes, we estimate that 18.2% of the wild return originated from UPSALM; 10.6% from MFSALM; 3.6% from SFSALM; 3.4% from LOSALM; 6.7% from UPCLWR; 7.6% from SFCLWR; 3.9% from the LOCLWR; 6.9% from IMNAHA; 16.2% from GRROND; and 23.1% from LSSNAKE. Aggregating by MPGs, 35.7%

of the wild return originated from the Salmon River; 18.1% from the Clearwater River; 6.9% from the Imnaha River; 16.2% from the Grande Ronde River; and 23.1% from the Lower Snake River.

Based on MM results, estimated escapement to LGD by stock was 7,789 fish for UPSALM (95% CI 6,283-10,139); 4,513 fish for MFSALM (95% CI 3,456-5,774); 1,519 fish for SFSALM (95% CI 1,034-2,179); 1,454 fish for LOSALM (95% CI 539-1,936); 2,848 fish for UPCLWR (95% CI 2,076-3,750); 3,235 fish for SFCLWR (95% CI 2,391-4,272); 1,660 fish for LOCLWR (95% CI 967-2,452); 2,950 fish for IMNAHA (95% CI 1,962-3,903); 6,917 fish for GRROND (95% CI 5,230-8,856); and 9,888 fish for LSNAKE (95% CI 8,097-12,882; Figure 7). Aggregating by MPGs, estimated escapement was 15,275 fish for the Salmon River (95% CI 13,249-17,275); 7,743 for the Clearwater River (95% CI 6,458-8,964); 2,950 fish for the Imnaha River (95% CI 1,962-3,903); 6,917 fish for the Grande Ronde River; 95% CI 5,230-8,856); and 9,888 fish for the Lower Snake River (95% CI 8,097-12,882).

Of the 1,915 fish with complete genotypes, 956 fish or 49.9% assigned to a stock with $\geq 80\%$ probability (Ackerman et al. 2012). Of the 956 assigned fish, 824 had both a determined sex and a total age and were used for genetic stock decomposition (Appendix Table C-10). Percentages of sex by age were calculated for each stock (Appendix Table C-11) and then applied to SY2010 stock escapement estimates (Appendix Table C-12).

Chinook Salmon Escapement

For SY2010 – from March 1 to August 17, 2010 – a total of 134,684 wild and hatchery Chinook salmon were counted at the LGD window or by video (Figure 8; Appendix Table D-1). This total combines adult and jack counts. The first fish was counted on March 28 and the last fish was counted on August 17. Of the total escapement, there were 82 fish or 0.1% of the run that passed during the August 14-17, 2009 trap closure. The trap was operational during 99.9% of the run.

At the adult trap, a total of 5,767 wild and hatchery Chinook salmon were captured and considered valid (Appendix Table D-1). The adult trap sampled 4.3% of the window count overall (weekly range 3.4-4.9%).

Of the Chinook salmon trapped, there were 1,205 wild fish, 4,271 hatchery clipped fish, and 291 hatchery unclipped fish (Appendix Table D-2). A total of 1,496 unclipped and 4,271 clipped fish were trapped.

We estimate that 20.5% of the run was wild, 74.3% was hatchery clipped, and 5.2% was hatchery unclipped (Appendix Table D-3). Of all returning unclipped fish, we estimate 20.1% were of hatchery origin, which is a minimum estimate based primarily on CWT. Of all returning hatchery fish, we estimate 6.5% were unclipped. Overall, 20.5% of the run was wild and 79.5% was of hatchery origin. However, the percentage of wild was not constant throughout the run and ranged from 10.1% in late-April to 31.9% in late-June 2010.

Of the total Chinook salmon escapement to LGD, we estimate that 27,664 fish (95% CI 26,304-29,099) were wild; 100,077 fish (95% CI 98,579-101,564) were hatchery clipped; and 6,943 fish (95% CI 6,215-7,734) were hatchery unclipped (Figure 9; Appendix Table D-4). The hatchery unclipped estimate is a minimum because unclipped hatchery fish without a CWT or ventral clip could not be identified. Overall, 27,664 wild (95% CI 26,304-29,099) and 107,020 hatchery (95% CI 105,663-108,366) Chinook salmon returned to LGD after combining clipped

and unclipped fish (Figure 10). Our total estimate of 34,607 unclipped fish, wild and hatchery combined, is 98.2% of the COE unreported window count of 35,235 unclipped fish (John Dalen, COE, personal communication).

Wild Chinook Salmon Age, Sex, and Stock Composition

Of the 1,205 wild Chinook salmon scale and genetics samples collected at the trap, we processed 1,194 for aging and genotyping (Appendix Table D-5). The first sample was collected on April 21 and the last was collected on August 10. We were able to assign total age to 1,151 samples or 4.2% of the estimated run size (weekly range 3.6-4.5%). We were able to assign gender to 1,133 samples or 4.1% of the run size (weekly range 3.6-4.6%). We were able to obtain complete genotype data ($\geq 90\%$ of SNPs amplify successfully) for 1,176 samples or 4.3% of the run size (weekly range 3.7-4.7%).

We observed nine different age classes from the 1,151 fish that we were able to assign a total age (Appendix Table D-6). Total age at spawning ranged from two to five years, with freshwater age ranging from zero to two years and saltwater age ranging from zero (mini-jack) to three years. We estimate that 0.2% of the wild return was from BY2008; 4.6% from BY2007; 88.1% from BY2006; and 7.1% from BY2005 (Appendix Table D-7).

Estimated escapement to LGD by age class was 24 fish for age 0.1 (95% CI 0-99); 24 fish for age 1.0 (95% CI 0-98); 24 fish for age 0.2 (95% CI 0-98); 1,250 fish for age 1.1 (95% CI 694-2,121); 24 fish for age 0.3 (95% CI 0-99); 24,275 fish for age 1.2 (95% CI 17,350-33,852); 96 fish for age 2.1 (95% CI 17-260); 1,346 fish for age 1.3 (95% CI 766-2,254); and 601 fish for age 2.2 (95% CI 285-1,127; Figure 11). Estimated escapement to LGD by saltwater age was 24 zero-saltwater fish (mini-jacks ≥ 30 cm, FL; 95% CI 0-80); 1,370 one-saltwater fish (jacks; 95% CI 954-1,865); 24,900 two-saltwater fish (95% CI 21,855-28,306); and 1,370 three-saltwater fish (95% CI 962-1,872). Estimated escapement to LGD by total age at spawning was 48 fish from BY2008 (95% CI 0-130); 1,274 fish from BY2007 (95% CI 887-1,719); 24,395 fish from BY2006 (95% CI 21,732-27,325); and 1,947 fish from BY2005 (95% CI 1,440-2,518; Figure 12).

Of the 1,133 fish that gender was successfully determined using the sex-specific assay, 497 were female and 636 were male (Appendix Table D-8). The gender percentages for the entire run were 43.9% female and 56.1% male (Appendix Table D-9). The sex ratio was generally male-biased throughout the run and ranged from 43.8 to 63.2% males. Expanding the overall percentages to the wild run gives 12,135 females (95% CI 10,942-13,434) and 15,529 males (95% CI 14,198-16,998; Figure 13). We estimate that 1.0% of the females were one-saltwater jills, 7.7% of the males were one-saltwater jacks, and 0.2% of the males were zero-saltwater mini-jacks ≥ 30 cm (FL).

Based on MM results using the 1,176 fish with complete genotypes, we estimate that 16.8% of the wild return originated from UPSALM; 16.4% from MFSALM; 4.2% from CHMBLN; 27.9% from SFSALM; 31.8% from HELLSC; and 0.2% from TUCANO. The remaining 2.8% of the wild return was identified as fall Chinook salmon based on multi-locus genotype data.

Based on MM results, estimated escapement to LGD by stock (and MPG) was 4,649 fish for UPSALM (95% CI 3,471-6,113); 4,527 fish for MFSALM (95% CI 3,184-5,708); 1,154 fish for CHMBLN (95% CI 674-1,746); 7,718 fish for SFSALM (95% CI 6,097-10,018); 8,790 fish for HELLSC (95% CI 7,129-10,983); and 50 fish for TUCANO (95% CI 0-93; Figure 14). In addition, an estimated 776 fish of the wild return were identified as fall Chinook salmon based on multi-locus genotype data (95% CI 671-898).

Of the 1,176 fish with complete genotypes, 553 fish or 47.0% assigned to a stock with $\geq 80\%$ probability (Ackerman et al. 2012). Of the 553 assigned fish, 511 had both a determined sex and a total age and were used for genetic stock decomposition (Appendix Table D-10). Percentages of sex by age were calculated for each stock (Appendix Table D-11) and then applied to SY2010 stock escapement estimates (Appendix Table D-12).

Age Validation

Readers accurately determined the ocean-age of 94% of the scale samples ($n = 54$) from known ocean-age PIT-tagged wild steelhead. The known ocean-age sample was approximately 57% one-saltwater and 43% two-saltwater fish. There were no three-saltwater or four-saltwater fish in the known ocean-age sample. Mean coefficient of variation between primary readers for wild fish analysis was 7.3% for freshwater age and 4.9% for saltwater age.

Readers accurately determined the ocean-age of 97% of the scale samples ($n = 117$) from known ocean-age PIT-tagged wild and hatchery Chinook salmon. The known ocean-age sample was approximately 6% one-saltwater, 87% two-saltwater, and 7% three-saltwater fish. There were no four-saltwater fish in the known ocean-age sample. Mean coefficient of variation between primary readers for wild fish analysis was 2.8% for freshwater age and 2.5% for saltwater age.

Stock Validation

We performed 100% simulations in the program ONCOR to test the resolution of the Snake River genetic baselines for MM (Ackerman et al. 2012). Of the 63 populations represented in the Snake River steelhead baseline v2.0, 53 populations exhibited $\geq 90\%$ mean correct allocation to the correct reporting group. Among the reporting groups, the SFSALM exhibited the greatest mean correct allocation; 99% of mixtures simulated from SFSALM populations assigned back to the SFSALM reporting group. Remaining mean correct allocation values, in descending order, include: UPCLWR at 99%; MFSALM at 98%; SFCLWR at 97%; LOCLWR at 97%; UPSALM at 96%; GRROND at 92%; IMNAHA at 89%; LSNAKE at 89%; and LOSALM at 87%. Of the 39 populations represented in the Snake River Chinook salmon baseline v2.0, all 39 exhibited $\geq 90\%$ mean correct allocation to the correct reporting group. Among the reporting groups, the CHMBLN, TUCANO, and FALL groups exhibited 100% allocation back to the correct reporting group followed closely by UPSALM at 99%, MFSALM at 99%, SFSALM at 98%, and HELLSC at 98%.

We performed self-assignment tests in the program gsi_sim to test the resolution of the current Snake River baselines to perform IA (Ackerman et al. 2012). Of the 63 populations represented in the Snake River steelhead baseline v2.0, 52 populations had $\geq 80\%$ of assigned baseline individuals assign back to the correct reporting group. Overall, of the 4,145 steelhead in the baseline, 2,617 fish or 63.1% assigned with $\geq 80\%$ probability, of which 2,371 fish or 90.6% assigned back to the correct reporting group. Of the 39 populations represented in the Snake River Chinook salmon baseline v2.0, 38 populations had $\geq 80\%$ of assigned baseline individuals assign back to the correct reporting group. Overall, of the 3,393 Chinook salmon in the baseline, 2,747 fish or 81.0% assigned with $\geq 80\%$ probability, of which 2,586 fish or 94.1% assigned back to the correct reporting group.

Using IA, we analyzed 134 steelhead that were PIT tagged at LGD by the ISEMP project and were later detected at tributary PIT-tag arrays or hatchery traps. Of these, 87 fish assigned

to a reporting group with $\geq 80\%$ probability, of which 80 fish had a genetic assignment matching the location of detection. Steelhead genetic IA concordance with tributary PIT-tag arrays or hatchery traps was 92.0%. We analyzed 79 Chinook salmon that were PIT tagged at LGD and were later detected at tributary PIT-tag arrays or hatchery traps. Of these, 54 fish assigned to a reporting group with $\geq 80\%$ probability, of which 50 fish had a genetic assignment matching the location of detection. Chinook salmon genetic IA concordance with tributary PIT-tag arrays or hatchery traps was 92.6%. Ackerman et al. (2012) describe more fully these analyses for SY2010 including results by location.

DISCUSSION

This report continues the wild Snake River steelhead and Chinook salmon comprehensive stock assessments, exclusive of some Tucannon River fish, begun by Schrader et al. (2011) using genetic stock identification and run decomposition. Our assessments are done at LGD before fish arrive at their spawning grounds. Prior to the SY2009 run (Schrader et al. 2011), wild steelhead stock assessments were done for the aggregate A-run and B-run at LGD (e.g., Busby et al. 1996, Good et al. 2005; Ford et al. 2010), and wild Chinook salmon stock assessments were done using data collected from spawning ground surveys or from the aggregate at LGD (e.g., Good et al. 2005; Ford et al. 2010). Our overall wild escapement estimates for both species at LGD is more refined than those done prior to Schrader et al. (2011) primarily because we attempt to account for unclipped hatchery fish. This is possible because we use morphological data (for steelhead) and tagging data (for steelhead and Chinook salmon) from fish that are handled at the adult trap. Previous estimates used window counts that are unadjusted for unclipped hatchery fish. Beginning in SY2012, we anticipate further refinement to our wild escapement estimates by using parentage based tagging (PBT) to identify unclipped hatchery fish (Steele et al. 2012). For both species, SY2012 will be the first year that age-4 fish will return from hatchery broodstock collections that were sampled for PBT starting in SY2008.

Ideally, the entire run at LGD would be counted accurately at the window or by video, and the entire run would be sampled in a completely systematic random manner at the adult trap. All passage would be through the fish ladder, and all fish passing once through the ladder would continue migrating upstream to spawn. It is well documented that this ideal scenario is not the case (e.g., Boggs et al. 2004; Steinhorst et al. 2010; Cassinelli and Rosenberger 2011; Beasley and White 2010; QCI 2011, 2012). However, despite the imperfections, we discuss below why our estimates are reasonably accurate (unbiased) and relatively precise, and why IDFG has continued using the same methodology for the last two decades for *U.S. vs. Oregon* TAC and other management forums (e.g., Table 3). Our hope is to make the reader aware of some issues related to counting and sampling fish at LGD in order to aid interpretation of our results, as well as to identify areas where improvement may be needed.

Our wild (and hatchery) escapement estimates are based on unadjusted window counts, i.e. we treat the counts as a complete census. However, there are a number of potential biases when estimating total adult escapement at LGR using unadjusted window counts. Fish may ascend the ladder, be counted, fall back, and reascend the ladder to be counted again, in which case the window count is an overestimate. Fish may fall back and die or go elsewhere downriver to spawn (overestimate). Fish may pass through the navigation lock or at night and not be counted at all (underestimate). Boggs et al. (2004) describe these issues in detail and they used radio telemetry to observe the fate of fish passing LGD during 1996-2001. Overall, they found that the LGD window counts were slightly and positively biased – of the window

counts, 91.2-96.6% (n = 4 yr) of steelhead and 95.0-99.5% (n = 5 yr) of spring-summer Chinook salmon continued upriver presumably to spawn. Hydrosystem management currently includes more spill than during the Boggs et al. (2004) study, so these percentages are likely different today. There are no radio telemetry studies similar to Boggs et al. (2004) currently being conducted at LGD to estimate fish-count bias or provide the needed adjustment factors on a yearly basis. However, there are several studies that have attempted to do so, at least partially, using PIT tags (Cassinelli and Rosenberger 2011) or a series of auto-regressive moving average models (Beasley and White 2010; QCI 2011, 2012).

Cassinelli and Rosenberger (2011) used PIT tags to: 1) adjust for the overestimation caused by double counting from fallback and reascension, and 2) adjust for the underestimation caused by after-hours passage. In general for hatchery spring-summer Chinook salmon, they showed that the overestimation caused by fallback and reascension is greater than the underestimation caused by after-hours passage. The net difference between the two would have resulted in the adult count at the window being 3,450 fish or 2.9% high and the jack count being 345 fish or 3.0% high in 2010. However, it is not possible to completely quantify alternate routes of passage or fallback and non-reascension using PIT tags due to incomplete coverage of PIT tag antennas at LGD and throughout the Columbia River basin. As many as 22.2% of radio-tagged steelhead and 28.6% of radio-tagged spring-summer Chinook salmon that fell back at LGD later entered tributaries or hatcheries downstream of LGD (Boggs et al. 2004). Further, not all spawning areas below LGD are currently monitored by PIT antenna arrays. Cassinelli and Rosenberger (2011) concluded that because PIT tags cannot be used for this direct assessment of fallback and non-reascension, their net difference of approximately 3% overestimation is likely a minimum estimate for 2010. Unfortunately, neither Boggs et al. (2004) nor Cassinelli and Rosenberger (2011) report navigation lock passage at LGD, but it has been documented to occur at lower Columbia River dams. There are currently no PIT antenna arrays on navigation locks or spillway bays. At the present time, any adjustments of escapement using PIT tag detections will be biased and incomplete to some unknown degree.

Beasley and White (2010; see also QCI 2011, 2012) used a series of Bayesian models that attempt to adjust for sampling inconsistencies in trap operation and fish ladder counts, such as trap closures and missing nighttime counts. For SY2010, our unadjusted LGD wild steelhead escapement estimate of 42,773 fish (95% CI 41,467-44,089; Figure 3) is significantly less than the estimate of 45,889 fish (95% CI 44,680-46,928) reported by the ISEMP project (QCI 2012). Our unadjusted wild Chinook salmon escapement estimate of 27,664 fish (95% CI 26,304-29,099; Figure 10) is greater than but not significantly different than their estimate of 26,465 fish (95% CI 24,650-27,929).

Another issue that may potentially bias our wild escapement and composition estimates is related to the sort-by-code process. There are two sampling processes or events that occur at the adult fish trap: systematic random sampling and sort-by-code. For the latter, the computer guiding the trap gate is programmed with a series of predetermined PIT tag codes. In SY2010, these included Lemhi River spring-summer Chinook salmon PIT tagged as juveniles (Bowersox and Biggs 2011); lower Columbia River spring-summer Chinook salmon sonic-tagged as adults (Rub et al. 2012); and Snake River fall Chinook salmon that were PIT tagged as juveniles (Doug Marsh, NMFS; personal communication). If one of these tags is detected in the ladder, the computer opens the trap gate and diverts the tagged fish into the trap. Although sort-by-code is assumed to be an independent sampling process or event, a potential problem arises because fish frequently migrate in groups; therefore, untagged "by-catch" fish may accompany the tagged individual. One result is that the percent of the run actually trapped is often higher than the desired trap rate (Appendix Tables C-1 and D-1). This is especially problematic for

estimates based on trap expansions (e.g., Steinhorst et al. 2010; QCI 2012) and leads to overestimation. To address this issue, our wild (and hatchery) escapement estimate is stratified over time (statistical weeks) and partitions the trap data into time groups along with the window counts. We assume that these extra by-catch fish are random and do not differ from the systematic sample in terms of origin or size. If true, the only effect of the sort-by-code by-catch is to increase the sample size for any particular time stratum. Until the various issues affecting the true trapping rate can be fully addressed, our escapement estimates based on window counts should be more accurate than estimates based on trap expansions.

The wild steelhead and Chinook salmon abundance estimates at LGD and other dams in the hydrosystem are used to plan fishing seasons. It is likely that our wild escapement estimates at LGD are slightly positively biased. However, they are still more accurate than estimates based solely on window counts due to our accounting for and removal of unclipped hatchery fish from wild fish estimates. This ensures for risk-averse planning in regards to harvest impacts on ESA-listed populations. Given greater scrutiny on steelhead in the Columbia River basin, our estimate will allow for a fishing season planning process similar to that for Chinook salmon. We note that IDFG managers have used our method of estimating wild steelhead escapement at LGD for several decades, and these estimates have been used in *U.S. vs. Oregon* TAC and other management forums (Table 3).

For our composition estimates, because we can systematically subsample all wild fish trapped at LGD, and because this sample pool can be considered a simple random sample selected in proportion to abundance, time stratification is not necessary (Kirk Steinhorst, University of Idaho, personal communication). The effective result is that the percent of the run actually aged and genotyped for sex and stock was approximately constant over time (Appendix Tables C-5 and D-5). It was not exactly constant over time because scale and tissue samples of wild fish were not taken from some portions of the run. This was due to trap closure, extra sort-by-code “by-catch” fish, and perhaps other unknown reasons. The trap typically closes in late summer due to high water temperatures and in early winter due to freezing water temperatures. We recommend that COE in conjunction with NMFS explore fixing the high water temperature issue, which is caused by the surface location of the fish ladder water intake. This would also likely result in more attractive fish ladder entrance water temperatures. In the meantime, adequate sampling prior to and after closure should allow valid interpolation of the data.

Abundance and stock composition estimation for spring-summer Chinook salmon at LGD could potentially be confounded by the short period of overlap in migration timing with fall-run Chinook salmon. Of the 27,664 wild Chinook salmon returning to LGD between March 1 and August 17, 2010, we estimate that 776 fish or 2.8% of the escapement during this period were actually fall Chinook salmon as determined by genetics, with the remaining 26,888 fish being spring-summer Chinook salmon. However, in addition to fall Chinook salmon identified within the spring-summer Chinook salmon escapement time period, it is also likely that some summer Chinook salmon arrive at LGD after the August 17 cutoff date. Several summer Chinook salmon individuals, based on phenotypic characteristics, were recorded by the trap crew after this date (Darren Ogden, NMFS, personal communication). Individual assignment testing of known origin samples indicates 100% accuracy in our ability to differentiate spring-summer Chinook salmon from fall Chinook salmon (Ackerman et al. 2012). In the future, we may use genetic individual assignment to assess the accuracy of these phenotypic characteristics to discriminate between the two run types.

We provide age composition estimates of steelhead and Chinook salmon adults at LGD based on scale analysis in this report and the previous report (Schrader et al. 2011). This is the

first year which we estimate repeat spawning steelhead as well as mini-jack Chinook salmon. Laboratory personnel continue to improve their aging techniques and validate their readings for fish that display these unusual life history strategies. For example, this year we used PIT tags and CWT to compare and validate known mini-jacks with their scale patterns. As our reference baseline for these unusual types of fish continues to grow as LGD samples are added, accuracy in age assignment should continue to improve. In addition, in SY2012 we will use the sort-by-code feature at LGD to sample known repeat spawning steelhead as determined by PIT tags. Another study to define life histories of Chinook salmon based on scales, including mini-jacks, was recently completed by Johnson et al. (*In Press*).

For SY2010, we estimate there were genetic individual assignment concordance rates of 92.0% for steelhead and 92.6% for Chinook salmon using tributary PIT-tag array or hatchery trap PIT-tag detections. However, caution should be used when interpreting these comparisons since the two methods measure fundamentally different things at different locations and at different scales. Genetic individual assignments are used to estimate the stock of *origin* for adults that return to LGD (Ackerman et al. 2012). The tributary PIT-tag arrays and hatchery traps attempt to estimate the final *destination* of adults that are sampled at LGD, with the assumption that their homing instinct returns most fish to their natal streams to spawn (Beasley and White 2010; QCI 2011, 2012). While we expect to see similarities between genetic and PIT-tag assignments, we also expect that wandering adults, straying adults, or genetic misassignments could lead to some discordance between the two methods. In the larger context, and for the only location that is directly comparable using the two methods, we note that our genetic stock estimate for South Fork Salmon River steelhead in SY2010 was 1,519 fish at LGD (95% CI 1,034-2,179; Figure 7) which is nearly identical and not statistically different from the ISEMP PIT-array escapement estimate of 1,497 fish (95% CI 1,229-1,765; QCI 2012). For South Fork Salmon River Chinook salmon, our genetic stock estimate of 7,718 fish at LGD (95% CI 6,097-10,018; Figure 14) is significantly greater than the ISEMP PIT-array escapement estimate of 4,671 fish (95% CI 4,331-5,011; QCI 2012). The latter discrepancy needs to be investigated but is beyond the scope of this report. However, we emphasize that both methods for both species are highly dependent on the wild escapement estimates generated at LGD which is also calculated using different methods. In addition, Ackerman et al. (2012) concluded that stock composition estimates based on genetic stock identification for both South Fork Salmon River reporting groups may slightly underestimate the true compositions based on mixture modeling of known origin individuals. A third independent method to estimate South Fork Salmon River Chinook salmon spawner abundance based on redd count expansions is currently being developed by IDFG and the Nez Perce Tribe.

The wild escapement and composition estimates reported here will be used to evaluate the status of wild populations relative to three viable salmonid population (VSP) criteria: abundance, productivity, and diversity. We directly estimate adult abundance at LGD as well as elements of diversity such as sex ratio, life history variations, and run timing. We estimate abundance by brood year through use of age data, and these estimates are necessary for productivity analyses. Productivity is the generational replacement rate, defined as the number of progeny per parent. In the future, estimates of wild adult abundance and composition will be combined with similar information for smolts from the LGD juvenile facility. This will enable us to estimate adult-to-adult, adult-to-juvenile, and juvenile-to-adult productivity. The data necessary to compute productivity accumulate over time. In general, it will take 4-5 years before the first productivity data are complete.

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TABLES

Table 1. Major population groups and independent populations within the Snake River steelhead distinct population segment (DPS) and spring-summer Chinook salmon evolutionary significant unit (ESU; ICBTRT 2003, 2005; Ford et al. 2010; NMFS 2011).

Snake River steelhead DPS	
Major population group	Population name
Lower Snake River	1. Tucannon River 2. Asotin Creek
Grande Ronde River	3. Lower Grande Ronde River 4. Joseph Creek 5. Wallowa River 6. Upper Grande Ronde River
Imnaha River	7. Imnaha River
Clearwater River	8. Lower Clearwater River 9. North Fork Clearwater River (extirpated) 10. Lolo Creek 11. Lochsa River 12. Selway River 13. South Fork Clearwater River
Salmon River	14. Little Salmon and Rapid Rivers 15. Chamberlain Creek 16. South Fork Salmon River 17. Secesh River 18. Panther Creek 19. Lower Middle Fork Salmon River 20. Upper Middle Fork Salmon River 21. North Fork Salmon River 22. Lemhi River 23. Pahsimeroi River 24. East Fork Salmon River 25. Upper Salmon River
Hells Canyon Tributaries (extirpated)	

Table 1. Continued.

Snake River spring-summer Chinook salmon ESU	
Major population group	Population name
Lower Snake River	1. Tucannon River 2. Asotin Creek (extirpated)
Grande Ronde/Imnaha Rivers	3. Wenaha River 4. Lostine River 5. Minam River 6. Catherine Creek 7. Upper Grande Ronde River 8. Imnaha River 9. Big Sheep Creek (extirpated) 10. Lookingglass Creek
South Fork Salmon River	11. Little Salmon River 12. South Fork Salmon River 13. Sesesh River 14. East Fork South Fork Salmon River
Middle Fork Salmon River	15. Chamberlain Creek 16. Lower Middle Fork Salmon River 17. Big Creek 18. Camas Creek 19. Loon Creek 20. Upper Middle Fork Salmon River 21. Sulphur Creek 22. Bear Valley Creek 23. Marsh Creek
Upper Salmon River	24. North Fork Salmon River 25. Lemhi River 26. Upper Salmon River Lower Mainstem 27. Pahsimeroi River 28. East Fork Salmon River 29. Yankee Fork Salmon River 30. Valley Creek 31. Upper Salmon River Upper Mainstem 32. Panther Creek (extirpated)
Dry Clearwater River (extirpated)	33. Potlatch River (extirpated) 34. Lapwai Creek (extirpated) 35. Lawyer Creek (extirpated) 36. Upper South Fork Clearwater River (extirpated)
Wet Clearwater River (extirpated)	37. Lower North Fork Clearwater River (extirpated) 38. Upper North Fork Clearwater River (extirpated) 39. Lolo Creek (extirpated) 40. Lochsa River (extirpated) 41. Meadow Creek (extirpated) 42. Moose Creek (extirpated) 43. Upper Selway River (extirpated)

Table 2. Status of the fish ladder, the fish counting window and video, and the adult trap sample rate at Lower Granite Dam, 7/1/2009 to 8/17/2010 (COE 2009; 2010; Ogden 2010; 2011).

Sampling period 2009-10	Statistical week	Ladder open?	Window count?	Video count?	Adult trap sample rate
7/1-7/5	27	Yes, Start 7/1/09, End 1/3/10 (except closed one day 11/17)	Yes, 0400-2000, Start 7/1/09, End 10/31/09	Yes, 0200-0400, Start 7/1/09, End 9/30/09 (not used for reported counts)	0.05 Rate, Start 7/1/09, End 7/20/09
7/6-7/12	28				Trap Closed, Start 7/21/09, End 8/17/09
7/13-7/19	29				
7/20-7/26	30				
7/27-8/2	31				
8/3-8/9	32				
8/10-8/16	33				
8/17-8/23	34				
8/24-8/30	35				
8/31-9/6	36				
9/7-9/13	37				
9/14-9/20	38				
9/21-9/27	39				
9/28-10/4	40				
10/5-10/11	41				
10/12-10/18	42				
10/19-10/25	43				
10/26-11/1	44				
11/2-11/8	45				
11/9-11/15	46				
11/16-11/22	47				
11/23-11/29	48				
11/30-12/6	49				
12/7-12/13	50				
12/14-12/20	51				
12/21-12/27	52				
12/28-1/3	53-1				
1/4-1/10	2	No, Start 1/4/10, End 2/2/10	No, Start 11/1/09, End 3/31/10	No, Start 1/1/10, End 2/28/10	Trap Closed, Start 11/16/09, End 2/28/10
1/11-1/17	3				
1/18-1/24	4				
1/25-1/31	5				
2/1-2/7	6				
2/8-2/14	7				
2/15-2/21	8				
2/22-2/28	9				
3/1-3/7	10				
3/8-3/14	11				
3/15-3/21	12				
3/22-3/28	13				
3/29-4/4	14				
4/5-4/11	15				
4/12-4/18	16				
4/19-4/25	17				
4/26-5/2	18				
5/3-5/9	19				
5/10-5/16	20				
5/17-5/23	21				
5/24-5/30	22				
5/31-6/6	23				
6/7-6/13	24				
6/14-6/20	25				
6/21-6/27	26				
6/28-7/4	27				
7/5-7/11	28				
7/12-7/18	29				
7/19-7/25	30				
7/26-8/1	31				
8/2-8/8	32				
8/9-8/15	33				
8/16-8/17	34				
					Trap Closed, Start 8/14/10, End 8/17/10

Table 3. Estimated annual total escapement, by fish size and origin, of steelhead at Lower Granite Dam (LGD), spawn years 1987-2010. Large fish are greater than or equal to 78 cm (FL) and small fish are less than 78 cm (FL). Clipped and unclipped refer to the adipose fin. All estimates were generated by IDFG and are the COE window counts adjusted by NMFS adult trapping data (Alan Byrne, IDFG, personal communication; Schrader et al. 2011; present study).

Spawn year	LGD window count(a)	Estimated number of steelhead at LGD that were:						Total hatchery	Total wild
		Large wild	Large hatchery clipped	Large hatchery unclipped	Small wild	Small hatchery clipped	Small hatchery unclipped		
1987	129,945	5,463	36,969	0	16,613	70,900	0	107,869	22,076
1988	71,402	5,347	13,473	0	20,164	32,418	0	45,891	25,511
1989	87,063	4,614	22,006	0	15,700	44,743	0	66,749	20,314
1990	131,348	8,042	39,866	0	16,937	66,503	0	106,369	24,979
1991	56,881	4,483	22,015	0	4,806	25,577	0	47,592	9,289
1992	99,085	3,182	11,883	0	14,135	69,885	0	81,768	17,317
1993	128,380	5,777	25,566	0	13,617	83,420	0	108,986	19,394
1994	59,674	1,790	15,895	0	7,332	34,657	0	50,552	9,122
1995	47,238	2,231	7,178	0	5,873	31,956	0	39,134	8,104
1996	79,145	1,334	8,317	0	6,721	62,773	0	71,090	8,055
1997	86,911	1,645	12,211	0	5,980	67,075	0	79,286	7,625
1998	86,646	1,325	10,878	0	7,424	67,019	0	77,897	8,749
1999	70,662	2,301	17,455	0	7,074	43,832	0	61,287	9,375
2000	74,051	914	8,834	0	10,184	54,119	0	62,953	11,098
2001	117,302	2,886	17,128	0	17,689	79,589	10	96,727	20,575
2002	268,466	3,174	30,677	0	37,545	191,091	5,979	227,747	40,719
2003	222,176	13,623	51,358	6,618	28,308	110,535	11,734	180,245	41,931
2004	172,510	7,254	23,058	2,132	21,892	106,334	11,840	143,364	29,146
2005	151,646	4,774	23,179	2,005	18,297	94,225	9,166	128,575	23,071
2006	158,165	3,544	26,143	3,345	14,586	96,644	13,903	140,035	18,130
2007	149,166	1,633	33,332	5,880	7,877	85,210	15,234	139,656	9,510
2008	155,142	2,924	20,513	3,446	11,242	102,374	14,643	140,976	14,166
2009	178,870	5,729	39,887	6,933	20,035	93,380	12,906	153,106	25,764
2010	323,382	4,330	16,309	2,634	38,443	231,167	30,499	280,609	42,773

(a) Downloaded from COE link 7/10/12.

FIGURES

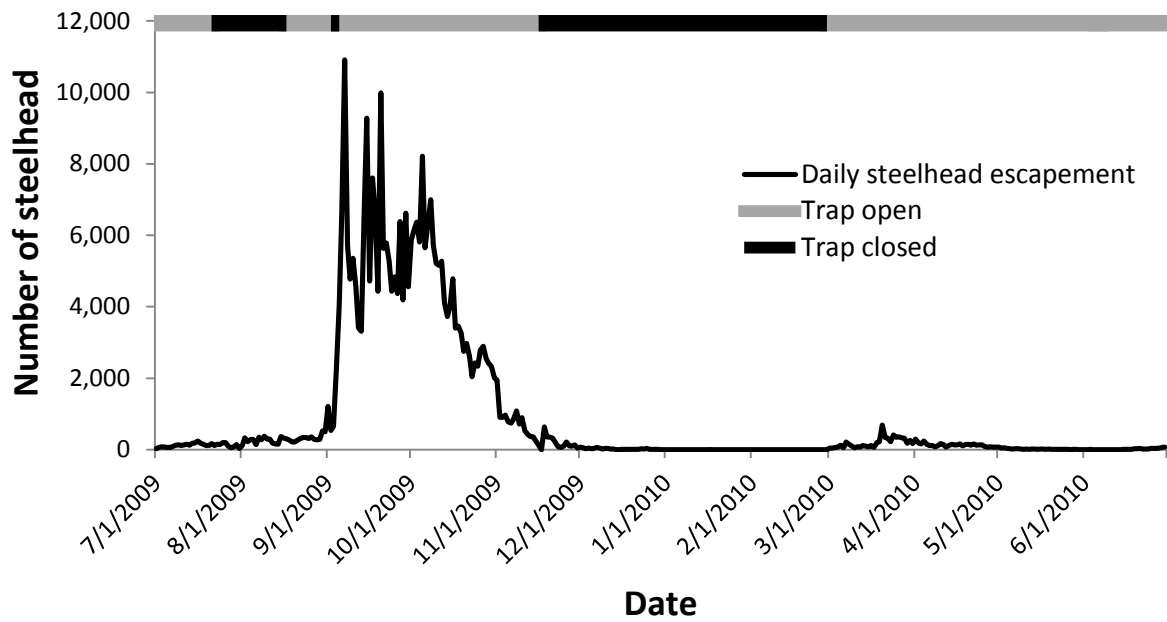


Figure 1. Daily number of steelhead counted at the Lower Granite Dam window or by video, spawn year 2010. Horizontal bar indicates when the adult trap was open or closed; overall, it was open during 94.8% of the total run ($n = 323,382$).

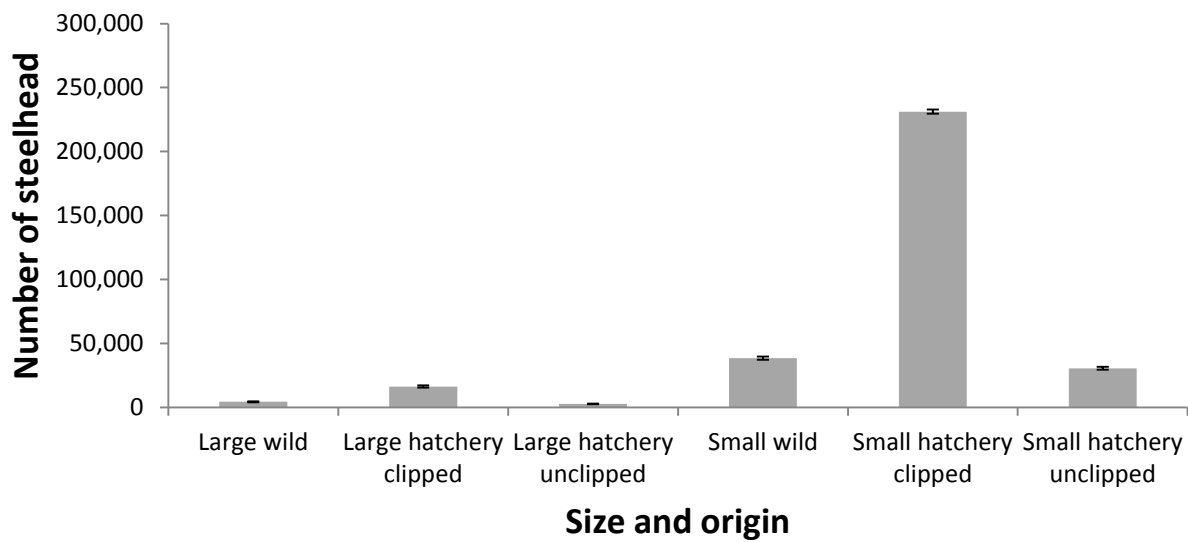


Figure 2. Estimated escapement, by fish size and origin, of steelhead at Lower Granite Dam, spawn year 2010. Large fish are greater than or equal to 78 cm (FL) and small fish are less than 78 cm (FL). Clipped and unclipped refer to the adipose fin. Confidence intervals are at 95%.

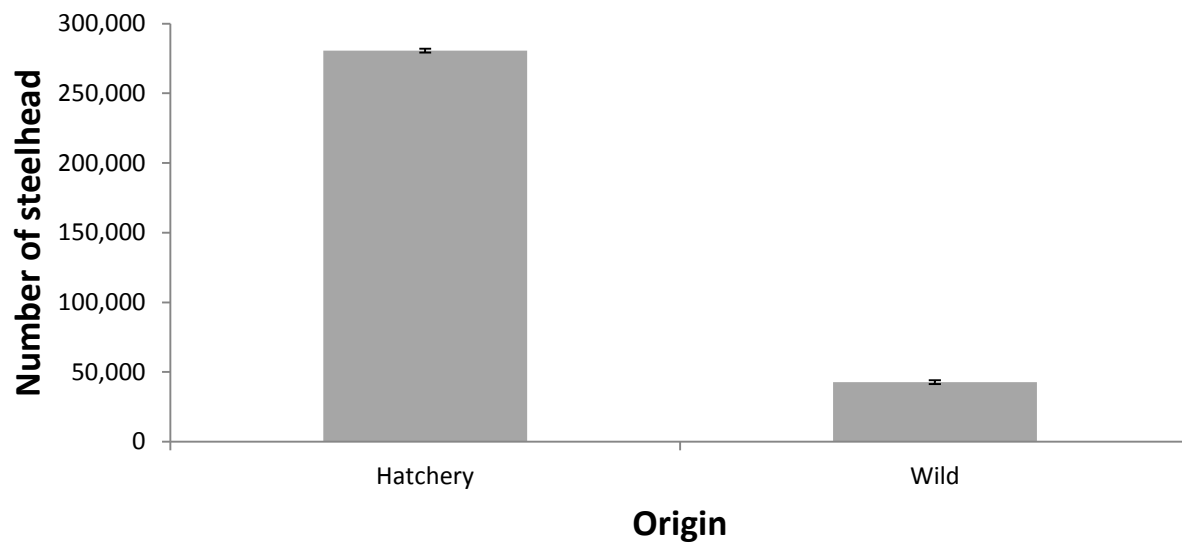


Figure 3. Estimated hatchery and wild steelhead escapement at Lower Granite Dam, spawn year 2010. Confidence intervals are at 95%.

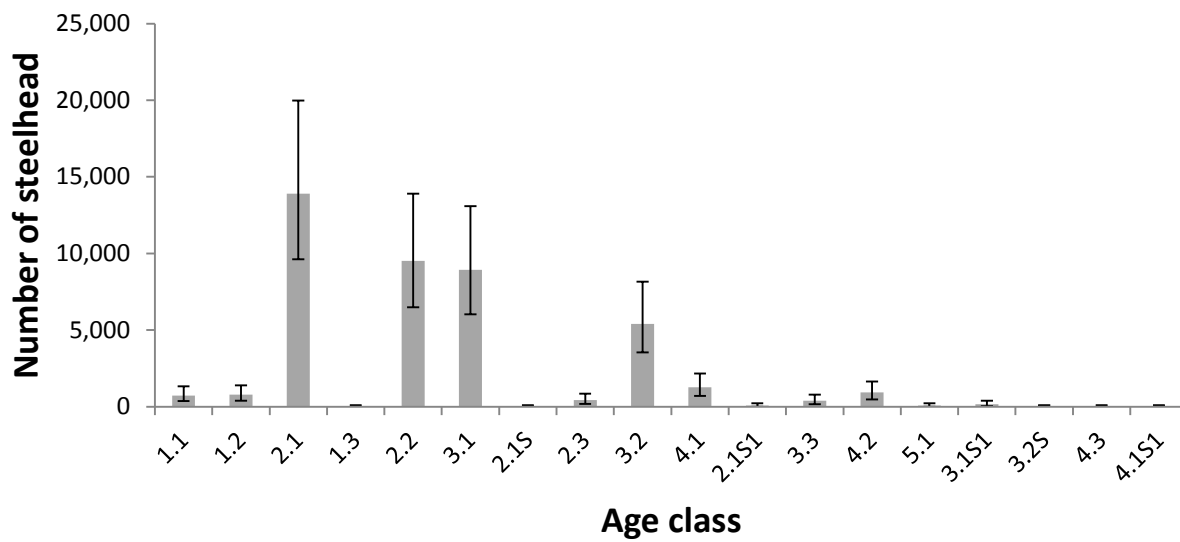


Figure 4. Estimated escapement by age class of wild adult steelhead at Lower Granite Dam, spawn year 2010. Large and small fish were combined. Confidence intervals are at 95%.

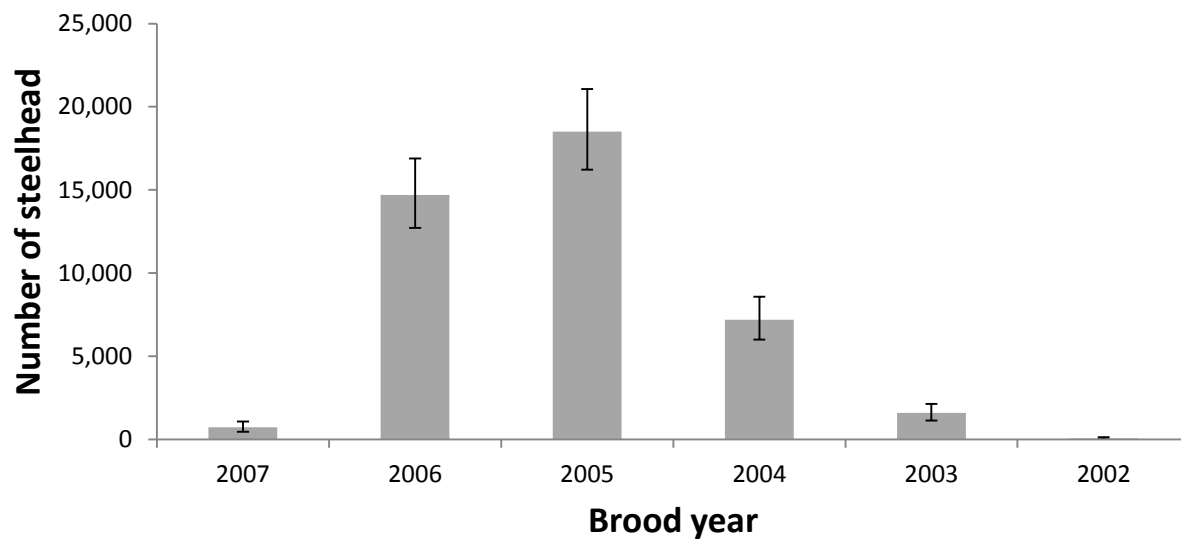


Figure 5. Estimated escapement by brood year of wild adult steelhead at Lower Granite Dam, spawn year 2010. Large and small fish were combined. Confidence intervals are at 95%.

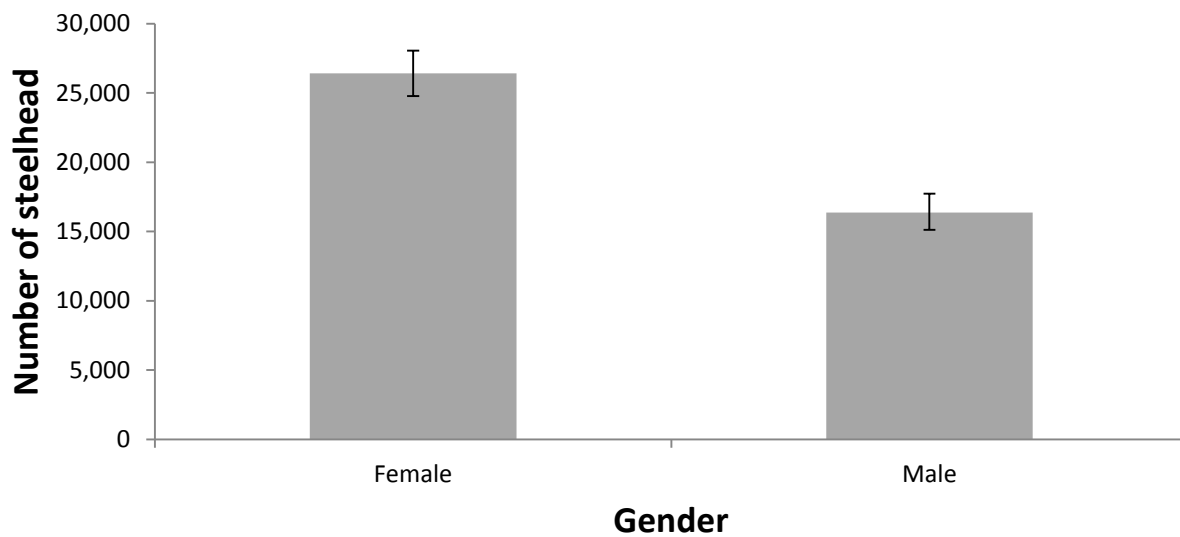


Figure 6. Estimated escapement by gender of wild adult steelhead at Lower Granite Dam, spawn year 2010. Large and small fish were combined. Confidence intervals are at 95%.

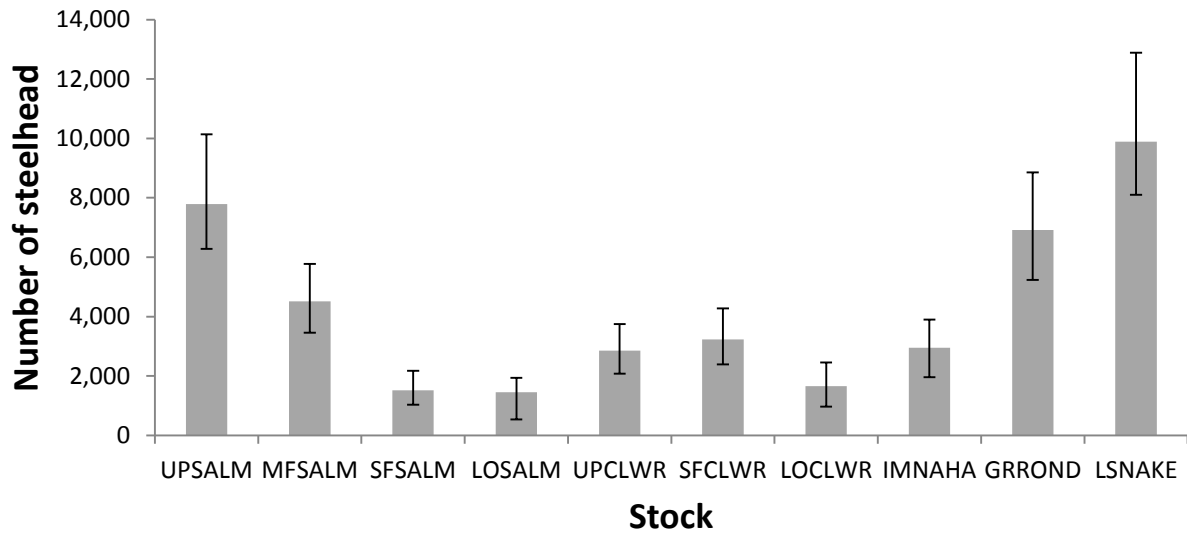


Figure 7. Estimated escapement by genetic stock of wild adult steelhead at Lower Granite Dam, spawn year 2010. Large and small fish were combined. Confidence intervals are at 95%. See Appendix Table B-1 for stock abbreviations.

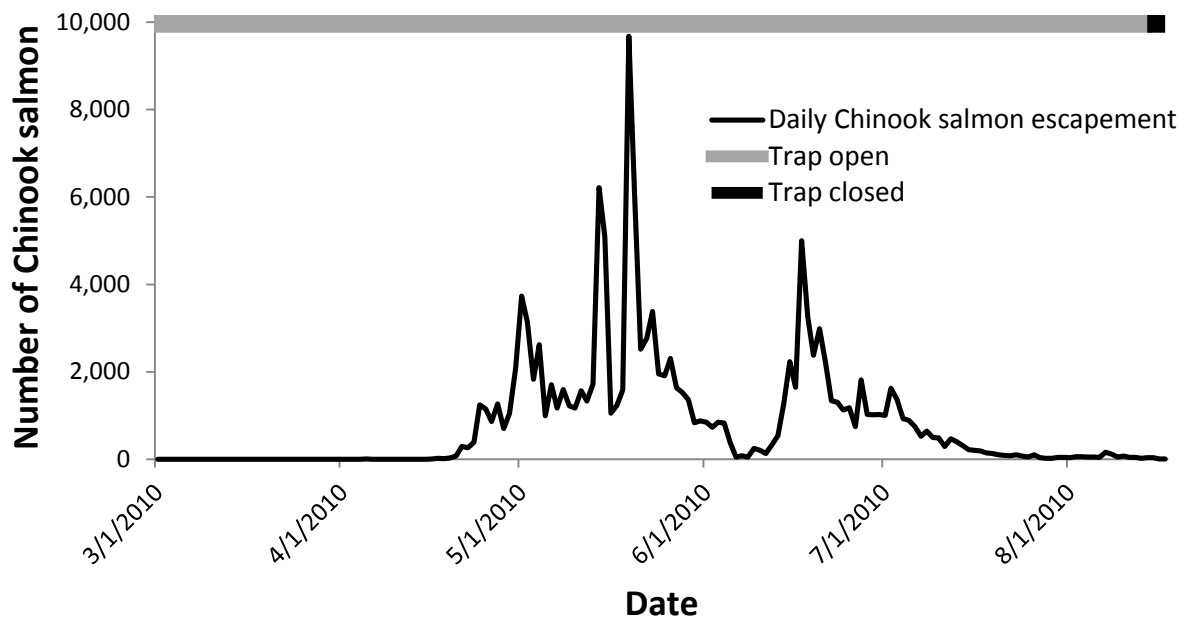


Figure 8. Daily number of Chinook salmon counted at the Lower Granite Dam window or by video, spawn year 2010. Horizontal bar indicates when the adult trap was open or closed; overall, it was open during 99.9% of the total run ($n = 134,684$).

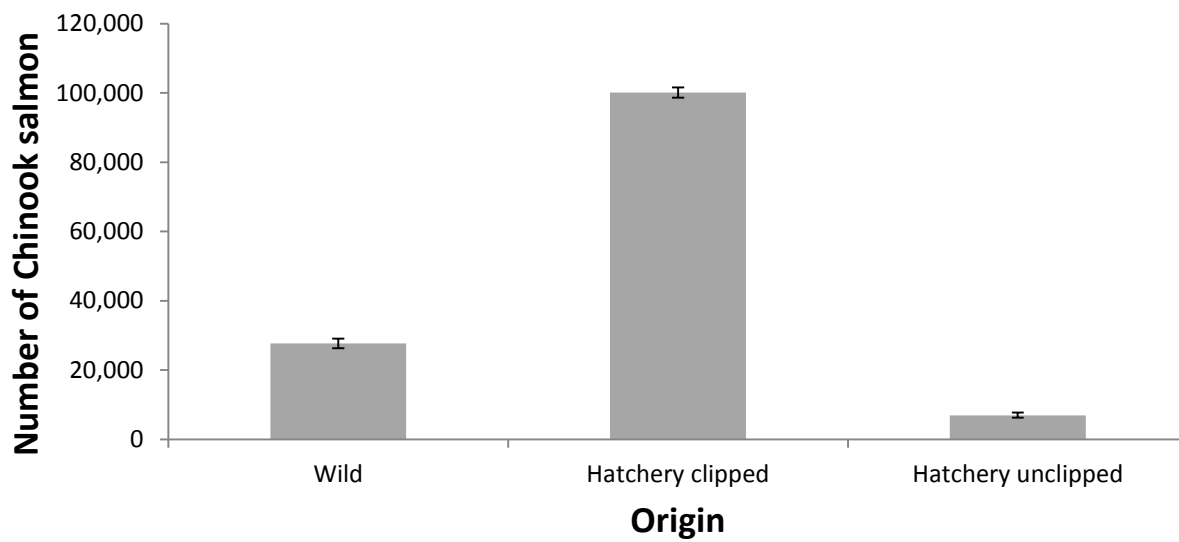


Figure 9. Estimated escapement by origin of Chinook salmon at Lower Granite Dam, spawn year 2010. Clipped and unclipped refer to the adipose fin. Confidence intervals are at 95%.

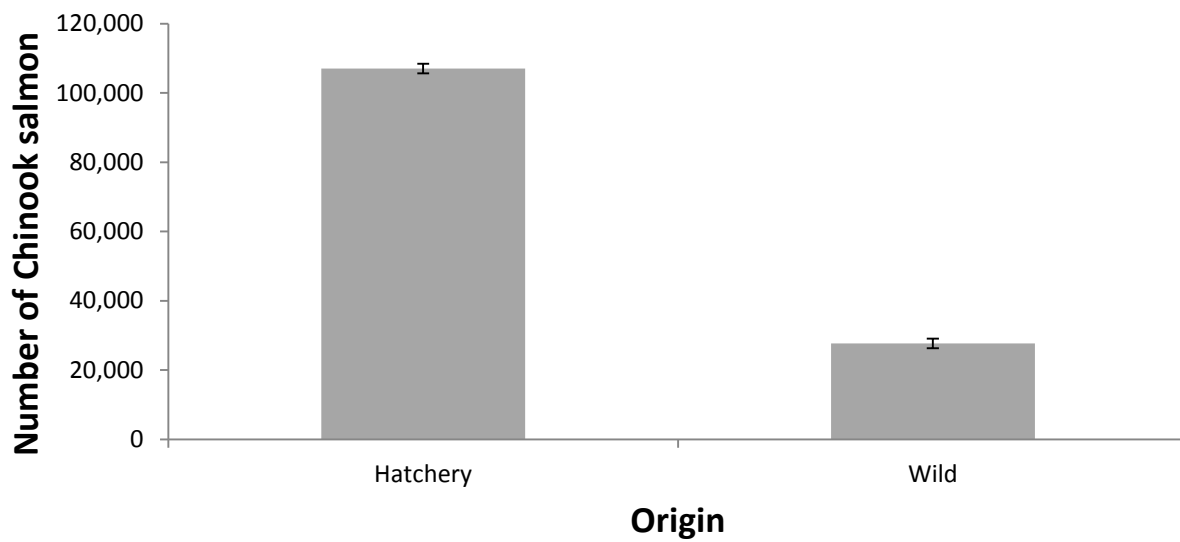


Figure 10. Estimated hatchery and wild Chinook salmon escapement at Lower Granite Dam, spawn year 2010. Confidence intervals are at 95%.

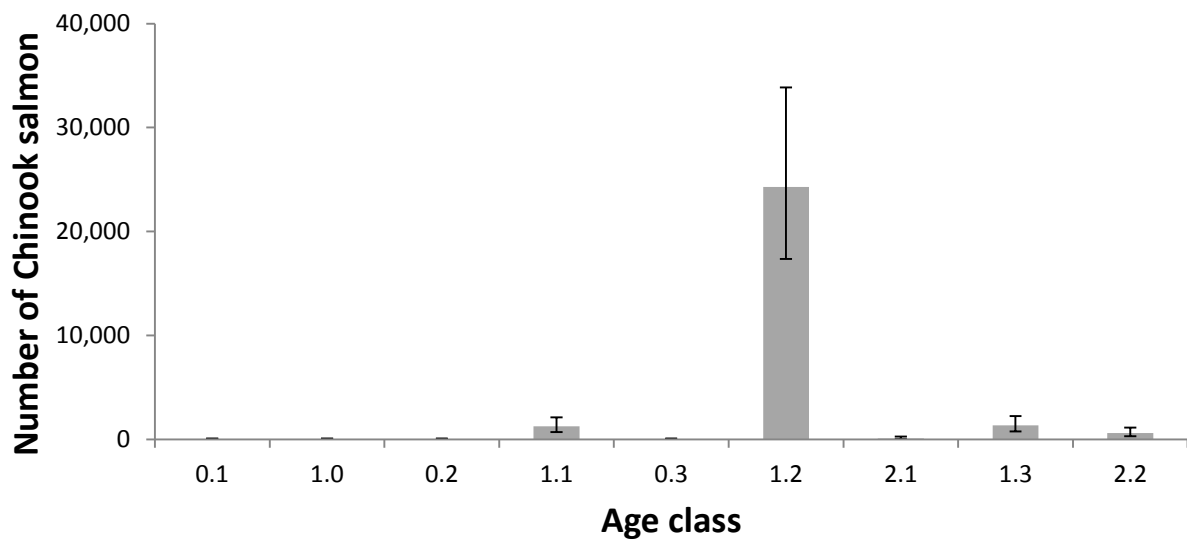


Figure 11. Estimated escapement by age class of wild adult Chinook salmon at Lower Granite Dam, spawn year 2010. Confidence intervals are at 95%.

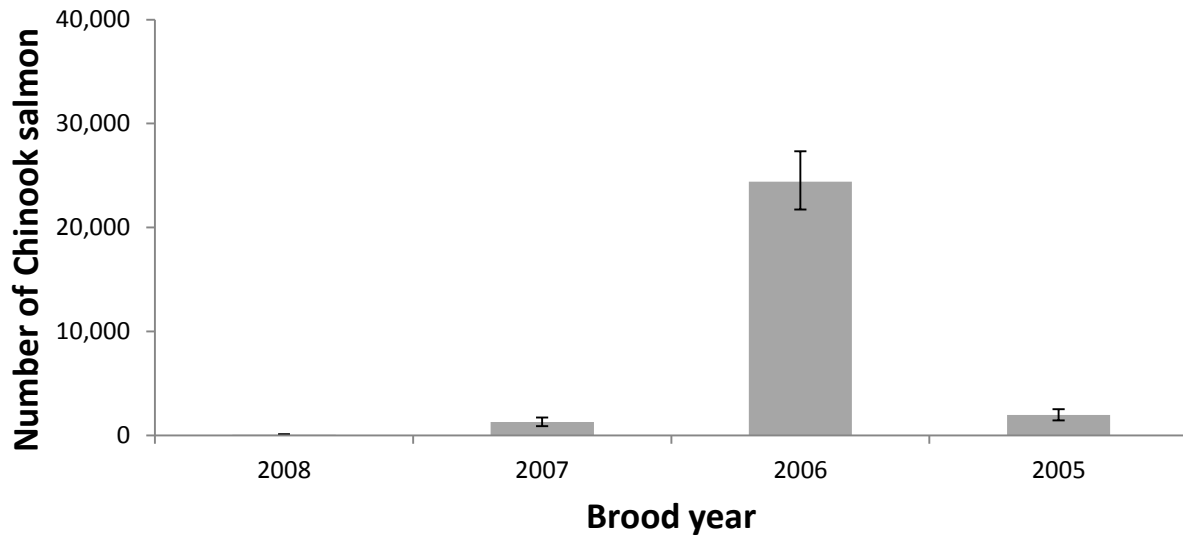


Figure 12. Estimated escapement by brood year of wild adult Chinook salmon at Lower Granite Dam, spawn year 2010. Confidence intervals are at 95%.

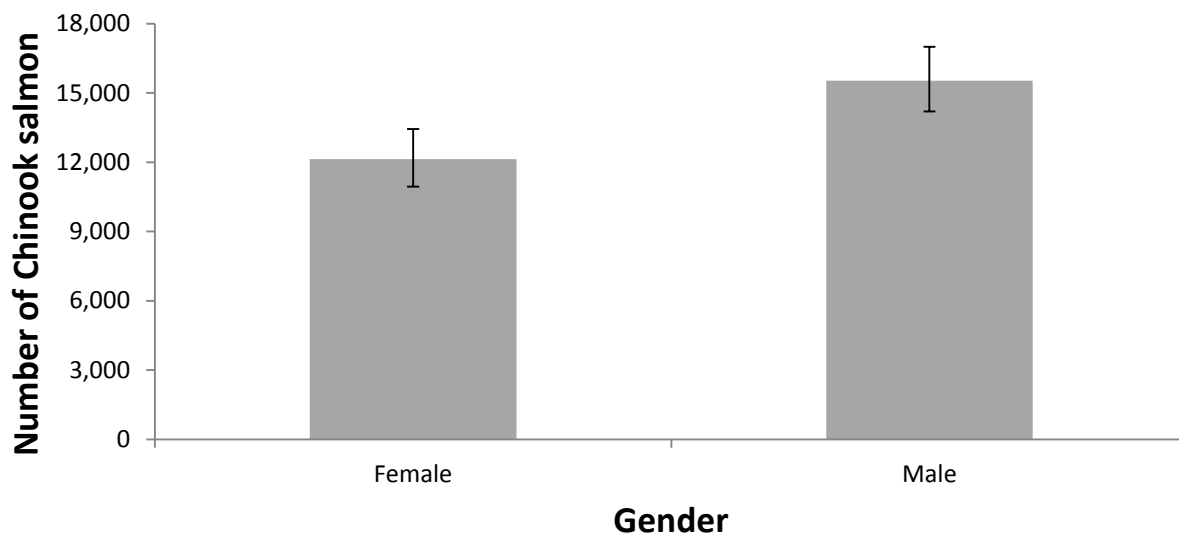


Figure 13. Estimated escapement by gender of wild adult Chinook salmon at Lower Granite Dam, spawn year 2010. Confidence intervals are at 95%.

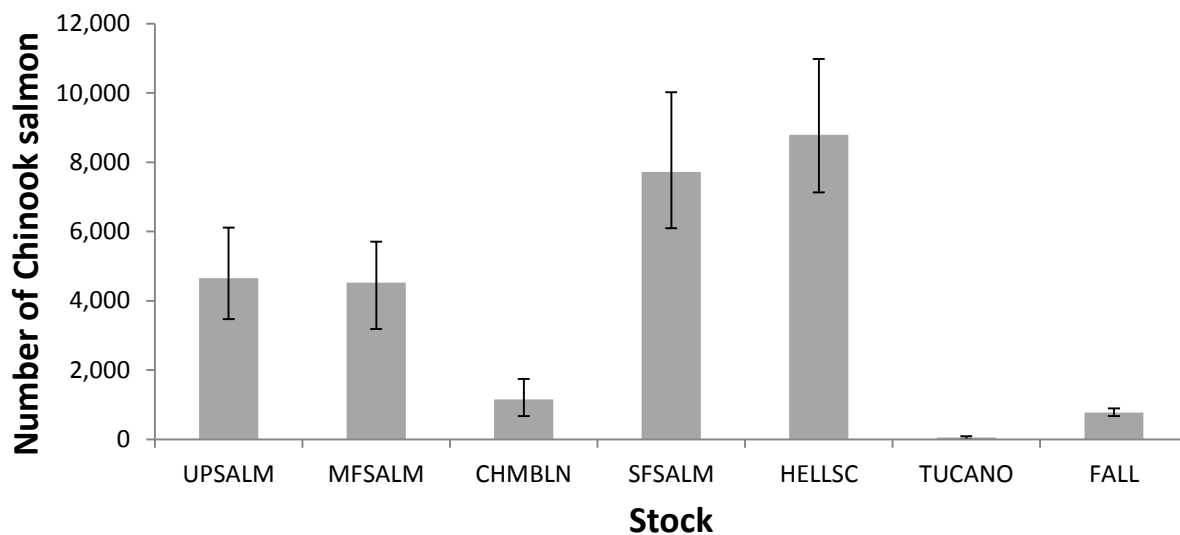


Figure 14. Estimated escapement by genetic stock of wild adult Chinook salmon at Lower Granite Dam, spawn year 2010. Confidence intervals are at 95%. See Appendix Table B-2 for stock abbreviations.

APPENDICES



2009 Lower Granite Dam Steelhead Field Sampling Protocol

Background

IDFG has annually requested biological sampling of steelhead at Lower Granite Dam to collect data for estimating: 1) the proportion of adipose fin clipped and unclipped fish; 2) the proportion of non-adipose fin clipped fish that are unmarked fish of hatchery origin (as evidenced by fin erosion associated with raceway rearing, i.e. “stubbies”) and the proportion that are of natural origin; 3) the length frequencies of adipose fin clipped hatchery fish, stubbies, and natural fish; 4) the age composition of hatchery and natural origin fish and; 5) the stock composition of hatchery and natural origin fish.

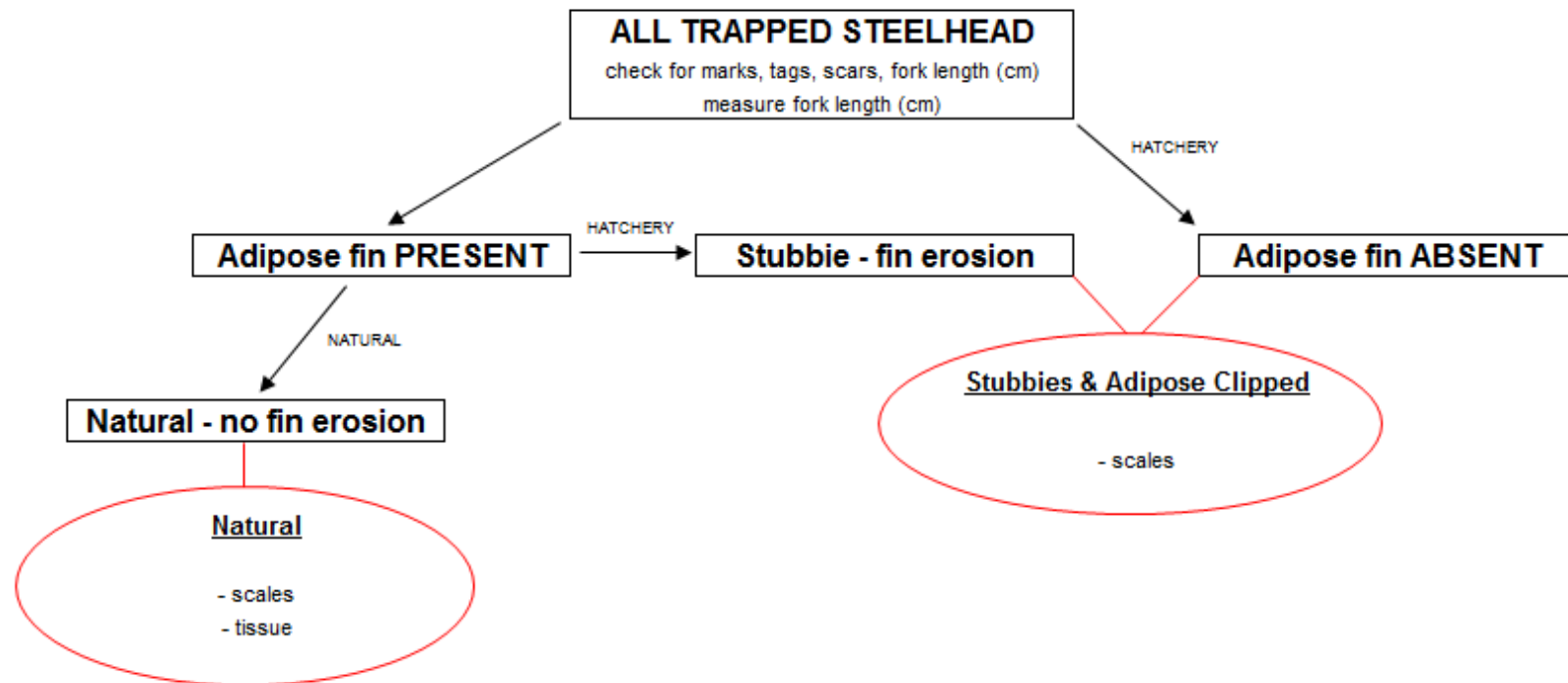
Steelhead at Lower Granite Dam in the fall are captured during the collection of fall Chinook broodstock, generally beginning August 18 unless the trap is shut down due to high water temperatures ($> 70^{\circ}\text{F}$). Sample rates among steelhead are dependent upon the permitted trapping rate for fall Chinook salmon. On August 29, 2007, NOAA Fisheries approved a revised trapping rate of 20% for fall Chinook at Lower Granite Dam. We will assume a similar rate for 2009. IDFG has modified the proposed sampling rates among trapped steelhead at Lower Granite Dam to be consistent with the new trapping rates and to provide sample sizes consistent with our aforementioned monitoring objectives.

Sampling

Sampling will be primarily directed towards natural origin fish although we also intend to collect a valid sample of hatchery fish. All trapped steelhead will be classified as adipose fin clipped hatchery fish, unclipped hatchery fish (“stubbies”), or unclipped natural origin fish. Clipped and unclipped hatchery fish will be lumped together for sampling purposes. Subsequent sampling rates will differ between hatchery and natural origin fish. All information will be generated from fish chosen for scale sampling. We may wish to post-stratify the population into early and late time strata, so the desired sample size is 1020 natural and 1020 hatchery samples.

NOAAF and IDFG personnel will sub-sample the fish collected at the trap. Sample rates will be prescribed by IDFG personnel. Proposed numbers of listed Snake River natural origin fish handled are within the take limits of Permit 1530.

All trapped fish will be visually scanned for the presence or absence of an adipose fin, and all unclipped fish will be visually scanned for the presence of fin erosion that typifies stubbies. All trapped fish will be examined for marks, tags, and scars. They will be measured to the nearest centimeter (fork length). For all sampled fish, five to six scales will be removed from the preferred area on both right and left sides of the fish, for a total of ten to twelve scales per sample. Scales should be left un-cleaned and stored in paper envelopes. Care should be taken to store envelopes in such a manner that they can dry quickly. Lastly, for all unclipped natural origin fish that are sampled, a tissue sample should be taken from one of the fins and stored in a closed vial with 100% ethanol for future genetics analysis.



Scale Sample Collection

Collection of scale samples requires following only a few simple steps. The two most important things to remember are to guard against cross contamination of samples and to make sure that all information is filled out on the sample envelopes. At every step of the collection process, care must be taken to keep individual samples separate.

Collection Packets

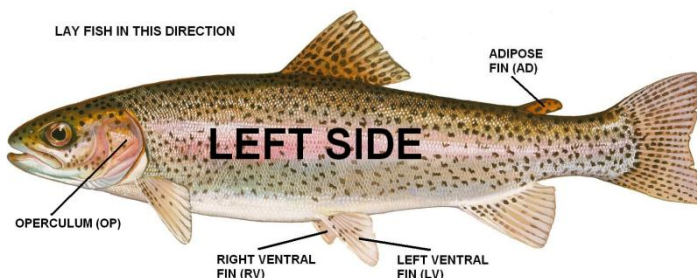
2 ½" x 4 ¼" (6.4 x 10.8 cm) Coin envelopes (as many as needed)

2" x 8" strips of paper (same # as coin envelopes)

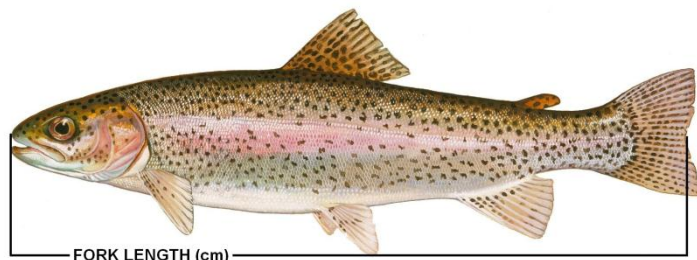
2" x 4" Mailing labels (Avery 5163) (same # as coin envelopes)

Species, Adult	YY-00000
Location	
Date: _____ male female unknown (circle one)	
Markings: None AD LV RV OP (circle one)	
Fork Length: _____ cm	MEHP Length _____ cm
Tags: None PIT CWT Other (circle one)	
Tag Number: _____	
Comments: _____	
Collector (full name): _____	

1. Species, life stage (Adult), sample number, and location will be filled out for you.
2. The date requested is the day you are taking the sample.
3. Circle the sex of the fish from which you are collecting the sample, if you are able to tell; if not, circle *unknown*. If you are just guessing, please circle unknown.
4. Make sure to circle one of the options for markings. If the fish is not marked circle *none*. AD = adipose fin clip. LV = left ventral fin clip. RV = right ventral fin clip. OP = Operculum Punch (this can be on either side of the fish and usually is a "hole punch" taken out of this area).



5. Measure fork length in centimeters. MEHP length is not recorded at LGD.



6. Scan the fish with a PIT tag detector. If one is present, circle PIT on the collection packet.
7. If the fish has a PIT tag, write down the number that the PIT tag detector gives you. **MAKE SURE** you have the number written down correctly. If the fish does not have a tag, put a dash on the Tag Number line.
8. In the comment line, put anything you feel may be of interest; for example, scars or deformities on the fish.
9. Print your full name on the collector line so that you may be contacted if necessary.

Make sure EVERY section is filled out.

Double check envelopes! If information is missing, the sample will be useless!!

Scale Sample Collection Method

Supplies:

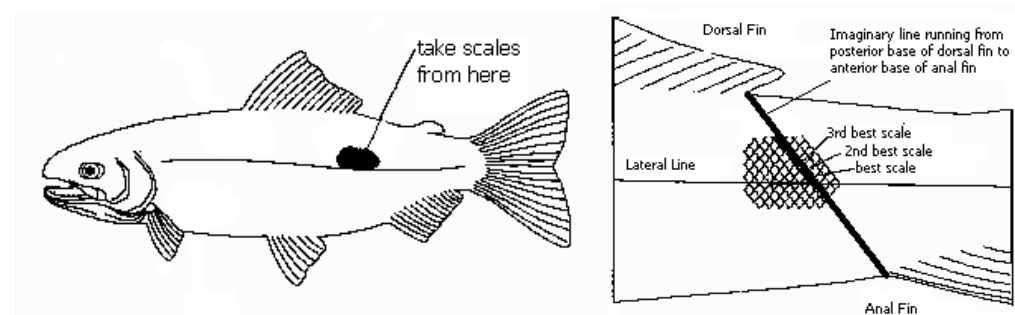
Forceps or tweezers

Knife

Rags or paper towels

Collection packet

1. Take any measurements requested (instructions for filling out the collection packet are above).
2. Clear away dirt from the area located on both sides of the fish, within six scales on either side of an imaginary line running from the posterior base of the dorsal fin to the anterior base of the anal fin and two to three scale rows above the lateral line.



3. The preferred collection method is to use forceps or tweezers to remove individual scales. However, a knife may be used to remove scales if several fish need to be handled in a very short amount of time.

Forceps/Tweezers

- a. Inspect for and remove from the forceps any scales from the previous sample collected.
- b. Five to six scales should be removed. Grasp a scale within the appropriate area and pull the scale from the fish.

Knife

- a. Inspect for and remove from the knife any scales from the previous sample collected.
- b. Five to six scales should be removed. Use the knife point to scrape with the grain in the preferred area.

4. Hold the scale up to the light checking to see if the scale is regenerated. A scale is regenerated if, when holding it up to the light, you do not see a small distinct focal point in the center of the scale. If you do not understand this, please ask. It is very important. If the scale is regenerated discard it and select another.
5. Wipe scales onto one side of the folded strip of paper found in the collection packet.
6. Repeat steps 2 through 5 on the opposite side of the fish until there are at least 10 scales on the paper.
7. Refold the strip of paper over the scales and place the strip of paper directly into the collection packet it was removed from.
8. **Make sure that all information requested is filled out on the collection packet.**

9. Seal the collection packet.
10. Wipe the forceps/knife with rag or paper towel and inspect for any scales remaining. If necessary rinse with water.
11. Place the collection packets on the drying rack at the end of your shift. Provide adequate space between the packets to promote air flow.

Genetic Sample Collection Method

Supplies:

Labeled sample vials filled with 100% ethyl alcohol

100% ethyl alcohol (for cleaning scissors)

Paper towels

Scissors

1. Clean the scissors with a paper towel to prevent cross contamination.
2. Clip a small tissue sample, about the size of your small fingernail, from one of the fins. Do not remove too much tissue. Too much tissue will overwhelm the sample vial alcohol.



3. Place the tissue sample in an alcohol-filled vial. Record the vial number on the data sheet.
4. Replace the alcohol in each sample vial at the end of the field season.

Mounting Scales

Supplies:

Scale packets

Bowl

Forceps

Blue shop towels (lint free)

Frosted end microscope slides (2x as many samples as need to be mounted)

Scotch tape

Empty coin envelopes (as many as scale packets that need to be mounted)

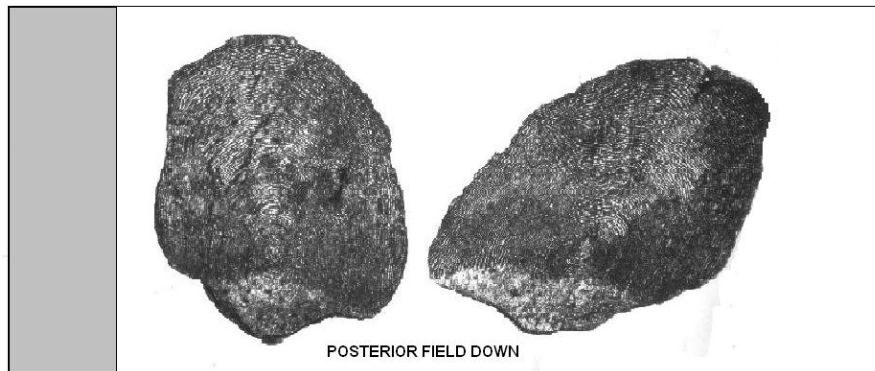
Labels (1"x 2 5/8" Avery 5160)

Fine point Sharpie pen

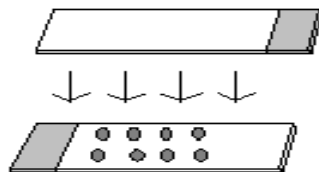
Sample tracking worksheet

1. Print sufficient mounted sample envelope labels. These labels consist only of a sample number and the location where the sample was taken.

2. Place the printed labels onto the empty coin envelopes, making sure that they are kept in numerical order.
3. Fill the bowl with water.
4. Lay a sheet of blue paper towel down on a clean, clear surface.
5. Lay out two of the frosted end microscope slides and write the sample number on the end of each with the fine point sharpie.
6. Select the eight best scales from the sample packet (Figures 1 and 2). Tape the sample packet closed again after removing the eight scales in order to prevent the remaining scales from falling out of the envelope.
7. Put the selected scales into the water in the bowl.
8. Remove one scale at a time and rub it between your fingers, removing any dirt and/or dried mucus.
9. When you are satisfied that the scale is clean, lay it on the blue paper towel to dry.
10. When all of the selected scales are clean, pat them dry with the paper towel.
11. Look at the scales under a microscope. Do not mount regenerated scales. Place up to eight dried scales on a frosted end microscope slide. Orient the scales in the same direction, either all posterior fields up or all posterior fields down.



12. Lay the other frosted end microscope slide down on top of the slide with scales on it, with the frosted end on the opposite end.



13. Place a piece of tape around each end to bind the slides together.
14. Place the mounted sample slides into the empty envelope that is labeled with the corresponding sample number.
15. Wipe the area clean making sure to dispose of ANY scales that you cannot positively attribute to a specific sample.
16. Keeping the envelopes containing the mounted samples in numerical order, place them into labeled containers.
17. Record the date each sample is mounted on the *Sample Tracking Worksheet*.

Figure 1. Good Scale – the focus of the scale is not regenerated (you can see the circuli in the center of the scale).

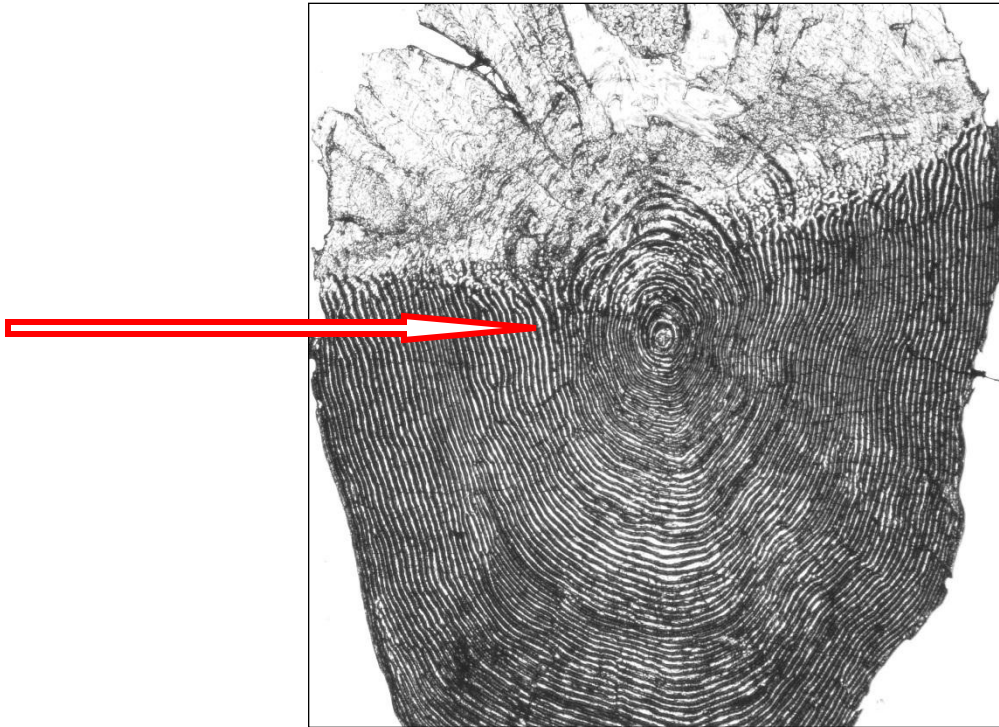
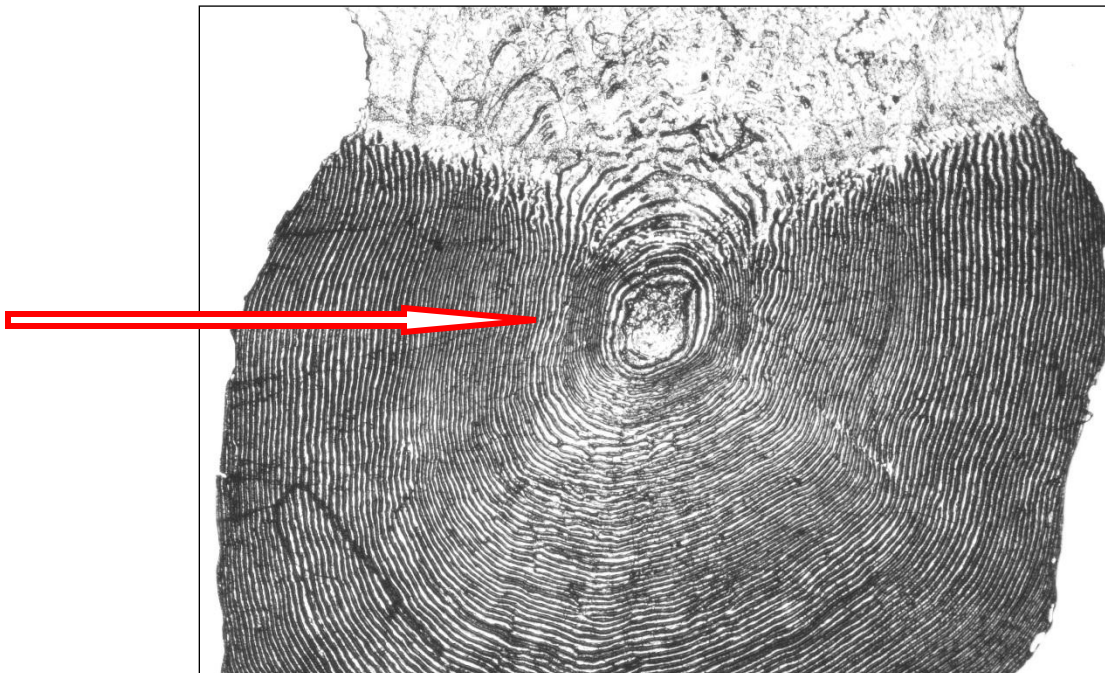


Figure 2. Bad Scale (Regenerated Scale) – because it is regenerated you can not see the circuli near the center of the scale. This is bad because we can not age it if it is missing this area. If all you have is regenerated scales, try to pick out the least regenerated ones (the ones with the smallest regenerated area).





Field Sampling Protocol for Steelhead and Spring/Summer Chinook Salmon at the Lower Granite Dam Adult Trap, March 1 to August 17, 2010

By:
IDFG, QCI, PSMFC, NOAAF

Specific Data Requirements for 2010 Season

This protocol outlines specific Lower Granite Dam (LGR) adult trap sampling and data management procedures for:

- 1) Documentation of marks, tags, fin clips, and fin erosion for all fish to determine the proportion by origin, the proportion of adipose intact fish that are unmarked fish of hatchery origin, etc;
- 2) Length measurements of all fish to determine length distribution, length at age, A/B partition, etc;
- 3) Scale collections from all natural origin fish and a sub-sample of hatchery origin fish to estimate age composition, length at age, etc;
- 4) Tissue collections from all natural origin fish and all PIT tagged hatchery origin fish to estimate contribution rates and sex ratios of fish migrating to specific Snake River genetic reporting groups;
- 5) Passive integrated tag (PIT) placement in all natural origin fish to estimate tributary specific escapement.

Once adult fish are trapped, all information from sampled fish will be recorded on the Field Data Entry Form, in the FS2001 PIT tag reader (set up FS2001 PIT tag reader correctly and header information is completed for each day of sampling; see FS2001 Reader Use Section), and on the associated scale collection packets and genetic tissue vials. An individual sampled fish must have an identical, corresponding number placed on the Field Data Entry Form, scale sample packets and/or tissue sample vial. Each fish will have a unique sample number. Below are the required elements of field data and the field data form:

1. All spring/summer Chinook salmon and steelhead from the trap will be classified as to species and whether adipose fin clipped hatchery fish; unclipped hatchery fish (see **Figure 1** – steelhead determined by fin erosion, other external marks, or CWT's; Chinook determined by other external marks or CWT's); or unclipped natural origin fish. Clipped and unclipped hatchery fish will be lumped together for sampling scales. All trapped fish will be visually scanned for the presence or absence of an adipose fin, and all unclipped steelhead will be visually scanned for the presence of fin erosion that typifies unclipped hatchery steelhead.

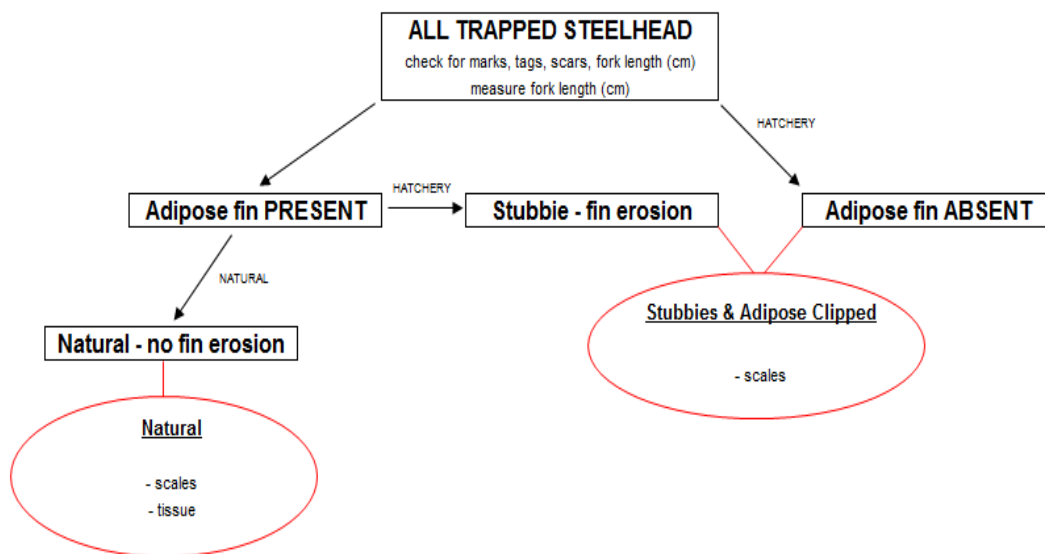
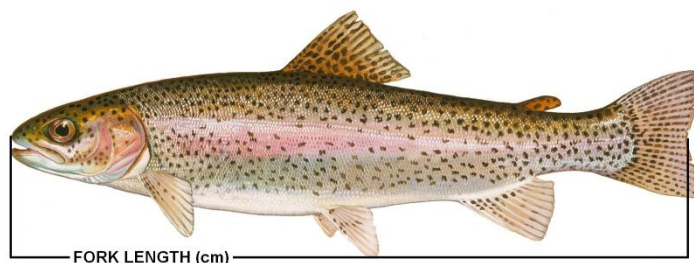


Figure 1. Steelhead wild/natural determination process.

2. All spring/summer Chinook salmon and steelhead from the trap will be examined for other fin clips (pelvic, pectoral, etc.), external marks (brands, elastomer, VIE, etc.), external tags (floy tags, jaw tags, etc.) and internal tags (PIT, CWT, radio tags) and noted in the appropriate columns on the field form.
 - a. If a PIT tag is detected, note on the form that it is a **recapture**, write down the entire PIT tag number and **continue with the tissue/scale sampling; however do not place another PIT tag into the fish.**
3. Any significant injuries will be noted in the comment column.
4. All spring/summer Chinook salmon and steelhead from the trap will be measured to the nearest centimeter (fork length).



5. For all spring/summer Chinook salmon and steelhead that are sampled, five to six scales will be removed from the preferred area on both right and left sides of the fish, for a total of ten to twelve scales per sample. Scales should be left un-cleaned and stored in paper envelopes. Care should be taken to store envelopes in such a manner that they can dry quickly. Sample number from the field form must correspond to the same number on the sample packet.
 - a. All natural origin fish from the trap will have scale samples taken.
 - b. A subsample, to be determined, of hatchery fish will be taken systematically across the run.

6. For all spring/summer Chinook salmon and steelhead that are sampled, a piece of tissue should be taken from the top of the caudal fin and stored in a closed vial with 100% ethanol for future genetics analysis. Sample number from the field form must correspond to the same number on the sample vial.
 - a. All natural origin fish from the trap will have tissue samples taken.
 - b. **Do not** take genetics tissues from hatchery fish unless it is PIT tagged.
7. For all spring/summer Chinook salmon and steelhead that are sampled, a 12 mm PIT tag should be placed in the pelvic girdle location using the provided pre-loaded PIT tag needles.
 - a. All natural origin fish from the trap will be released with a single PIT tag, either newly tagged at the trap or from a previous tagging event (e.g. recaptured from juvenile PIT tagging, Bonneville PIT tagging, etc).
 - b. **Do not** PIT tag the fish if it is already PIT tagged, i.e. no double tagging.
 - c. After tagging, wand the fish with the FS2001 to ensure the PIT tag is placed appropriately in the fish.
 - d. Note the last 5 digits of the PIT tag code, and time of placement – record in the appropriate columns on the field data.
8. **Make sure tissue/scale samples are collected from every new PIT-tagged fish and every recaptured PIT-tagged fish.** The only exception to this rule is PIT tagged fallback fish when previous tissue/scale sample collection is obvious. Please record PIT numbers for fallbacks.

Scale Sample Collection for 2010 Season

Collection of scale samples requires following only a few simple steps. The two most important things to remember are to guard against cross contamination of samples and to make sure that all information is filled out on the sample envelopes. At every step of the collection process, care must be taken to keep individual samples separate.

Collection Packets

2 ½" x 4 ¼" (6.4 x 10.8 cm) Coin envelopes (as many as needed)

2" x 8" strips of paper (same # as coin envelopes)

2" x 4" Mailing labels (Avery 5163) (same # as coin envelopes)

Species, Adult	YY-00000
Location _____	
Date: _____ male female unknown (circle one)	
Markings: None AD LV RV OP (circle one)	
Fork Length: _____ cm	MEHP Length _____ cm
Tags: None PIT CWT Other (circle one)	
Tag Number: _____	
Comments: _____	
Collector (full name): _____	

1. Species, life stage (Adult), sample number (**matches that on data form**), and location will be filled out for you.
2. The date requested is the day you are taking the sample.
3. Circle appropriate marks
4. Fill in Fork length
5. Fill in the PIT tag number.
6. In the comment line, put anything you feel may be of interest; for example, scars or deformities on the fish.

Scale Sample Collection Method

Supplies:

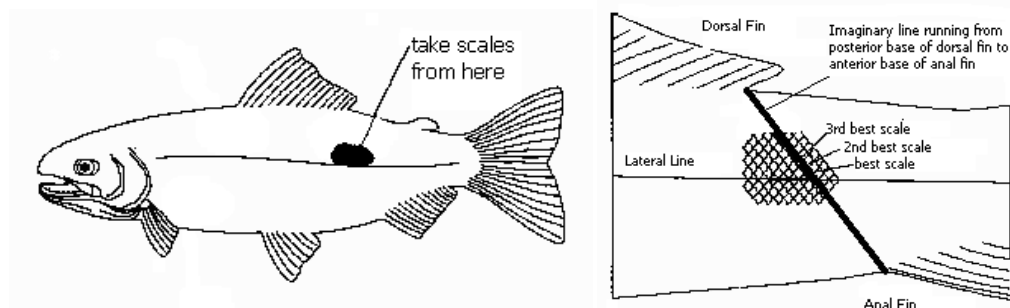
Forceps or tweezers

Knife

Rags or paper towels

Collection packet

1. Take any measurements requested (instructions for filling out the collection packet are above).
2. Clear away dirt from the area located on both sides of the fish, within six scales on either side of an imaginary line running from the posterior base of the dorsal fin to the anterior base of the anal fin and two to three scale rows above the lateral line.



3. The preferred collection method is to use forceps or tweezers to remove individual scales. However, a knife may be used to remove scales if several fish need to be handled in a very short amount of time.

Forceps/Tweezers

- a. Inspect for and remove from the forceps any scales from the previous sample collected.
- b. Five to six scales should be removed. Grasp a scale within the appropriate area and pull the scale from the fish.

Knife

- c. Inspect for and remove from the knife any scales from the previous sample collected.
 - d. Five to six scales should be removed. Use the knife point to scrape with the grain in the preferred area.
4. Hold the scale up to the light checking to see if the scale is regenerated. A scale is regenerated if, when holding it up to the light, you do not see a small distinct focal point in the center of the scale. If you do not understand this, please ask. It is very important. If the scale is regenerated discard it and select another.
 5. Wipe scales onto one side of the folded strip of paper found in the collection packet.

6. Repeat steps 2 through 5 on the opposite side of the fish until there are at least 10 scales on the paper.
7. Refold the strip of paper over the scales and place the strip of paper directly into the collection packet it was removed from.
8. **Make sure that all information requested is filled out on the collection packet.**
9. Seal the collection packet.
10. Wipe the forceps/knife with rag or paper towel and inspect for any scales remaining. If necessary rinse with water.
11. Place the collection packets on the drying rack at the end of your shift. Provide adequate space between the packets to promote air flow.

Genetic Sample Collection for 2010 Season

Supplies:

Labeled sample vials filled with 100% ethyl alcohol

100% ethyl alcohol (for cleaning scissors)

Paper towels

Scissors

1. Rinse the scissors and wipe with a paper towel to prevent cross contamination.
2. Clip a small tissue sample, about the size of your small fingernail, from the top of the caudal fin. Do not remove too much tissue. Too much tissue will overwhelm the sample vial alcohol.



3. Place the tissue sample in an alcohol-filled vial. Record the vial number on the data sheet.
4. Replace the alcohol in each sample vial at the end of the field season.

FS 2001 Operational Instructions

Note: all tag files will be emailed, daily if possible, to Jody White (QCI) at jody@qcinc.org

Jody will be responsible for uploading all PIT tag information to PTAGIS daily from the LGD adult trapping operation.

Required Header information:

File Title: JSWyyddd.LGD (note: <yyddd> = year and Julian date of day of tagging)

Tag Date: MM/DD/YY hh:mm (note: usually filled in by software)

Tagger: Ogden D

Hatchery Site:

Stock:

Brood YR:

Migratory YR: 10

Tag Site: LGRLDR

Raceway/Transect:

Capture Method: LADDER

Tagging Temp: nn.n (note: <nnn> = 18.5, the starting daily temp in C)

Post Tagging Temp:

Release Water Temp:

Tagging Method: HAND

Organization: QCI

Coordinator ID: JSW

Release Date:

Release site:

Release River KM:

Appendix B: Snake River genetic baselines v2.0 (Ackerman et al. 2012) used for stock identification at Lower Granite Dam, spawn year 2010.

Appendix Table B-1. Genetic reporting groups and baseline collections used for steelhead mixed stock analysis at Lower Granite Dam, spawn year 2010 (Ackerman et al. 2012). MPG = major population group.

Reporting group / Collection name	<i>n</i>	Years collected	Latitude	Longitude	MPG
UPSALM (Upper Salmon River)					
1 Sawtooth Weir	108	05, 10	44.151	-114.885	Salmon
2 Valley Cr	45	05	44.223	-114.927	Salmon
3 WF Yankee F Salmon	117	04, 08	44.351	-114.730	Salmon
4 Morgan Cr	37	00	44.613	-114.164	Salmon
5 Pahsimeroi Weir	99	06, 10	44.682	-114.040	Salmon
6 Hayden Cr	90	09, 10	44.862	-113.632	Salmon
7 NF Salmon R	102	10	45.409	-113.992	Salmon
MFSALM (Middle Fork Salmon River)					
8 Marsh Cr	59	00	44.449	-115.230	Salmon
9 Sulphur Cr	46	00	44.553	-115.297	Salmon
10 Rapid R (MF)	45	00	44.679	-115.149	Salmon
11 Pistol Cr	23	00	44.722	-115.149	Salmon
12 Loon Cr	84	99, 00	44.598	-114.812	Salmon
13 Camas Cr	57	00	44.892	-114.722	Salmon
14 Big Cr (upper)	46	00	45.151	-115.297	Salmon
15 Big Cr (lower)	48	00	45.092	-114.730	Salmon
16 Chamberlain Cr	47	00	45.452	-114.931	Salmon
17 Bargamin Cr	32	00	45.572	-115.192	Salmon
SFSALM (South Fork Salmon River)					
18 EF SF Salmon R	47	00	45.013	-115.713	Salmon
19 Stolle Meadows	45	00	44.607	-115.681	Salmon
20 Secesh R	45	00	45.027	-115.708	Salmon
21 Lick Cr	39	10	45.069	-115.814	Salmon
LOSALM (Lower Salmon River)					
22 Boulder Cr	47	00	45.202	-116.311	Salmon
23 Rapid R	101	03, 09	45.372	-116.356	Salmon
24 Slate Cr	47	00	45.638	-116.283	Salmon
25 Whitebird Cr	62	00, 01	45.752	-116.320	Salmon
UPCLWR (Upper Clearwater River)					
26 Colt Cr	38	00	46.431	-114.540	Clearwater
27 Storm Cr	38	00	46.461	-114.547	Clearwater
28 Crooked F Lochsa R	44	00	46.525	-114.679	Clearwater
29 Lake Cr	47	00	46.463	-114.997	Clearwater
30 Fish Cr	100	10, 11	46.334	-115.347	Clearwater
31 Canyon Cr	47	11	46.216	-115.556	Clearwater
32 Selway R	78	08	45.692	-114.718	Clearwater
33 Little Clearwater R	59	08	45.744	-114.789	Clearwater
34 Whitecap Cr	76	08	45.869	-114.721	Clearwater
35 Bear Cr	36	00	46.019	-114.838	Clearwater
36 NF Moose Cr	94	00, 04	46.163	-114.897	Clearwater
37 Three Links Cr	47	00	46.096	-115.072	Clearwater
38 Gedney Cr	45	00	46.058	-115.314	Clearwater
39 O'Hara Cr	47	00	46.081	-115.518	Clearwater
SFCLWR (South Fork Clearwater River)					
40 Crooked R	109	07, 08	45.821	-115.527	Clearwater
41 Tenmile Cr	47	00	45.806	-115.683	Clearwater
42 John's Cr	40	00	45.822	-115.889	Clearwater
43 Clear Cr	45	00	46.049	-115.781	Clearwater

Appendix Table B-1, continued.

Reporting group / Collection name	<i>n</i>	Years collected	Latitude	Longitude	MPG
LOCLWR (Lower Clearwater River)					
44 WF Potlatch R	85	09, 10	46.805	-116.418	Clearwater
45 EF Potlatch R	160	08, 10, 11	46.798	-116.419	Clearwater
46 Big Bear Cr	99	07, 08, 10, 11	46.631	-116.656	Clearwater
47 Little Bear Cr	151	07, 08, 10, 11	46.637	-116.678	Clearwater
IMNAHA (Imnaha River)					
48 Big Sheep Cr	69	01	45.557	-116.834	Imnaha
49 Camp Cr	24	01	45.557	-116.835	Imnaha
50 Cow Cr	44	00	45.768	-116.750	Imnaha
51 Lightning Cr	39	00	45.655	-116.727	Imnaha
GRROND (Grande Ronde River)					
52 Little Minam R	48	00	45.400	-117.672	Grande Ronde
53 Lostine R	45	00	45.552	-117.490	Grande Ronde
54 Elk Cr	45	00	45.705	-117.153	Grande Ronde
55 Joseph Cr	60	11	46.028	-117.018	Grande Ronde
56 Crooked Cr	97	01	45.977	-117.555	Grande Ronde
57 Menatchee Cr	73	99	46.007	-117.365	Grande Ronde
58 Wenaha R	94	01	45.945	-117.451	Grande Ronde
LSNAKE (Lower Snake River)					
59 Captain John Cr	56	00	46.151	-116.934	Grande Ronde
60 George Cr	96	10	46.303	-117.117	Lower Snake
61 Asotin Cr	99	08, 10	46.323	-117.137	Lower Snake
62 Alpowa Cr	98	10	46.408	-117.220	Lower Snake
63 Tucannon R	108	05, 09, 10	46.310	-117.657	Lower Snake

Appendix Table B-2. Genetic reporting groups and baseline collections used for Chinook salmon mixed stock analysis at Lower Granite Dam, spawn year 2010 (Ackerman et al. 2012). MPG = major population group.

Reporting group / Collection name	<i>n</i>	Years collected	Latitude	Longitude	MPG
UPSALM (Upper Salmon River)					
1 Sawtooth Weir	92	09, 10	44.151	-114.885	Upper Salmon
2 Valley Cr	59	07, 08, 09, 10	44.223	-114.927	Upper Salmon
3 WF Yankee F Salmon	75	05	44.349	-114.727	Upper Salmon
4 EF Salmon R	187	04, 05, 11	44.115	-114.430	Upper Salmon
5 Pahsimeroi R	97	07, 08, 09, 10	44.682	-114.039	Upper Salmon
6 Hayden Cr	80	09, 10	44.862	-113.632	Upper Salmon
7 Lemhi (upper)	96	09, 10	44.869	-113.625	Upper Salmon
8 Lemhi (lower)	90	09, 10	45.153	-113.814	Upper Salmon
MFSALM (Middle Fork Salmon River)					
9 Capehorn Cr	113	05, 06, 07, 09, 10	44.388	-115.174	MF Salmon
10 Marsh Cr	67	07, 08, 09, 10	44.381	-115.153	MF Salmon
11 Elk Cr	91	07, 08, 09, 10	44.442	-115.454	MF Salmon
12 Bear Valley Cr	85	07, 08, 09, 10	44.427	-115.328	MF Salmon
13 Sulphur Cr	37	08, 09, 10	44.534	-115.358	MF Salmon
14 Camas Cr	61	06, 09	44.892	-114.721	MF Salmon
15 Big Cr	95	01, 10	45.138	-115.038	MF Salmon
CHMBLN (Chamberlain Creek)					
16 Chamberlain Cr (post-2008)	56	09, 10	45.452	-114.931	MF Salmon
17 Chamberlain Cr (pre-2008)	70	03, 04, 06, 07	45.454	-114.933	MF Salmon
SFSALM (South Fork Salmon River)					
18 Lake Cr, Summit Cr	78	07, 08, 09, 10	45.279	-115.922	SF Salmon
19 Secesh R	134	01, 07, 08, 09, 10	45.217	-115.808	SF Salmon
20 Johnson Cr	92	02	44.899	-115.492	SF Salmon
21 SF Salmon R	143	09, 10	44.667	-115.703	SF Salmon
HELLSC (Hells Canyon Stock)					
22 Rapid R	91	06	45.372	-116.356	SF Salmon
23 Crooked F Lochsa R	29	07, 08, 09, 10	46.506	-114.681	Wet Clearwater
24 Powell Weir	32	09	46.506	-114.687	Wet Clearwater
25 Red R	73	07, 08, 09, 10	45.710	-115.344	Dry Clearwater
26 Crooked R Weir	67	09, 10	45.817	-115.527	Dry Clearwater
27 Newsome Cr	82	01	45.831	-115.608	Dry Clearwater
28 Lolo Cr	89	01, 02	46.279	-115.775	Wet Clearwater
29 Imnaha R	46	08	45.620	-116.845	Grande Ronde / Imnaha
30 Imnaha R (1998)	91	98	45.561	-116.834	Grande Ronde / Imnaha
31 Upper Grande Ronde	46	08	45.132	-118.365	Grande Ronde / Imnaha
32 Catherine Cr	94	04, 06	45.158	-117.779	Grande Ronde / Imnaha
33 Lostine R	177	03, 05, 09	45.542	-117.555	Grande Ronde / Imnaha
34 Minam R	81	94, 02	45.600	-117.729	Grande Ronde / Imnaha
35 Wenaha R	88	02, 06	45.946	-117.455	Grande Ronde / Imnaha
TUCANO (Tucannon River)					
36 Tucannon R	81	03	46.526	-118.142	Lower Snake
FALL (Fall Chinook ESU)					
37 Clearwater	152	08	46.520	-116.610	FALL ESU
38 Nez Perce Tribal Hatchery	85	03	46.519	-116.665	FALL ESU
39 Lyons Ferry	90	00	46.589	-118.220	FALL ESU

Appendix C: Wild adult steelhead at Lower Granite Dam, spawn year 2010.

Appendix Table C-1. Weekly window or video counts and adult valid trap samples of steelhead at Lower Granite Dam (LGD), spawn year 2010.

Statistical week(a)	Sampling period 2009-10	Number of days	LGD window count(b)	LGD adult valid trap sample(c)	LGD adult trap sample rate (%)	Percent of run trapped
Fall 2009						
27-30(d,e)	7/1-7/26	26	3,382	97	0-5	2.9
31-34(e)	7/27-8/23	28	6,511	189	0-12	2.9
35	8/24-8/30	7	2,387	304	12	12.7
36(f)	8/31-9/6	7	15,836	679	0-12	4.3
37	9/7-9/13	7	38,038	4,424	9-12	11.6
38	9/14-9/20	7	49,358	4,864	9	9.9
39	9/21-9/27	7	36,708	3,841	9	10.5
40	9/28-10/4	7	39,565	4,063	9	10.3
41	10/5-10/11	7	43,269	4,050	9	9.4
42	10/12-10/18	7	28,744	2,840	9	9.9
43	10/19-10/25	7	18,412	1,635	9	8.9
44	10/26-11/1	7	16,931	1,750	9	10.3
45	11/2-11/8	7	6,246	571	9	9.1
46-53(g)	11/9-12/31	53	7,043	397	0-9	5.6
Fall total:		184	312,430	29,704	0-12	9.5
Spring 2010						
1-9(h)	1/1-2/28	59	ND(i)	ND	ND	ND
10	3/1-3/7	7	619	110	15	17.8
11	3/8-3/14	7	665	147	15	22.1
12	3/15-3/21	7	1,717	253	15	14.7
13	3/22-3/28	7	2,321	435	15	18.7
14	3/29-4/4	7	1,505	283	15	18.8
15	4/5-4/11	7	885	161	15	18.2
16	4/12-4/18	7	865	140	4-15	16.2
17-27(d)	4/19-6/30	73	2,375	89	4	3.7
Spring total:		181	10,952	1,618	4-15	14.8
Run total:		365	323,382	31,322	0-15	9.7

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 trapped fish.

(b) Downloaded from COE link 7/10/12.

(c) From Darren Ogden (NMFS, personal communication).

(d) Includes partial beginning or ending week.

(e) The trap was closed 7/21 to 8/17 due to high water temperatures.

(f) The trap was closed 9/2 to 9/5 due to high water temperatures.

(g) The trap was closed 11/16 to 12/31 due to freezing water temperatures.

(h) The window and trap were closed 1/1 to 2/28; the fish ladder was closed 1/4 to 2/2 and fish passage was only by navigation lock.

(i) ND = no data.

Appendix Table C-2. Number of steelhead captured in the adult trap, by fish size and origin, at Lower Granite Dam (LGD), spawn year 2010. Large fish are greater than or equal to 78 cm (FL) and small fish are less than 78 cm (FL). Clipped and unclipped refer to the adipose fin.

Statistical week(a)	Sample period ending(b)	LGD adult valid trap sample(c)	Number of trapped fish that were(c):							
			Large wild	Large hatchery clipped	Large hatchery unclipped	Small wild	Small hatchery clipped	Small hatchery unclipped	Total hatchery	Total wild
Fall 2009										
27-30	7/26	97	0	0	1	0	83	13	97	0
31-34	8/23	189	0	1	0	54	119	15	135	54
35	8/30	304	0	0	0	79	204	21	225	79
36	9/6	679	3	2	1	130	485	58	546	133
37	9/13	4,424	16	19	3	630	3,349	407	3,778	646
38	9/20	4,864	39	49	2	570	3,802	402	4,255	609
39	9/27	3,841	35	75	7	396	3,014	314	3,410	431
40	10/4	4,063	47	202	5	422	3,026	361	3,594	469
41	10/11	4,050	67	281	30	386	2,897	389	3,597	453
42	10/18	2,840	77	276	30	264	1,917	276	2,499	341
43	10/25	1,635	53	210	29	145	1,051	147	1,437	198
44	11/1	1,750	41	248	54	184	1,050	173	1,525	225
45	11/8	571	9	56	16	77	351	62	485	86
46-53	12/31	397	10	42	14	56	228	47	331	66
Fall total:		29,704	397	1,461	192	3,393	21,576	2,685	25,914	3,790
Spring 2010										
1-9	2/28	ND(d)	ND	ND	ND	ND	ND	ND	ND	ND
10	3/7	110	0	10	13	9	59	19	101	9
11	3/14	147	1	27	12	11	68	28	135	12
12	3/21	253	5	43	12	35	125	33	213	40
13	3/28	435	13	42	18	60	223	79	362	73
14	4/4	283	3	27	20	40	132	61	240	43
15	4/11	161	0	13	10	24	63	51	137	24
16	4/18	140	3	5	4	24	69	35	113	27
17-27	6/30	89	1	1	1	24	46	16	64	25
Spring total:		1,618	26	168	90	227	785	322	1,365	253
Run total:		31,322	423	1,629	282	3,620	22,361	3,007	27,279	4,043

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 trapped fish.

(b) See Appendix Table C-1 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) From Darren Ogden (NMFS, personal communication).

(d) ND = no data.

Appendix Table C-3. Percentage of steelhead captured in the adult trap, by fish size and origin, at Lower Granite Dam (LGD), spawn year 2010. Large fish are greater than or equal to 78 cm (FL) and small fish are less than 78 cm (FL). Clipped and unclipped refer to the adipose fin. Percentages may not sum to 100.0% due to rounding error.

Statistical week(a)	Sample period ending(b)	LGD adult valid trap sample(c)	Percentage of trapped fish that were:							
			Large wild	Large hatchery clipped	Large hatchery unclipped	Small wild	Small hatchery clipped	Small hatchery unclipped	Total hatchery	Total wild
Fall 2009										
27-30	7/26	97	0.0	0.0	1.0	0.0	85.6	13.4	100.0	0.0
31-34	8/23	189	0.0	0.5	0.0	28.6	63.0	7.9	71.4	28.6
35	8/30	304	0.0	0.0	0.0	26.0	67.1	6.9	74.0	26.0
36	9/6	679	0.4	0.3	0.1	19.1	71.4	8.5	80.4	19.6
37	9/13	4,424	0.4	0.4	0.1	14.2	75.7	9.2	85.4	14.6
38	9/20	4,864	0.8	1.0	0.0	11.7	78.2	8.3	87.5	12.5
39	9/27	3,841	0.9	2.0	0.2	10.3	78.5	8.2	88.8	11.2
40	10/4	4,063	1.2	5.0	0.1	10.4	74.5	8.9	88.5	11.5
41	10/11	4,050	1.7	6.9	0.7	9.5	71.5	9.6	88.8	11.2
42	10/18	2,840	2.7	9.7	1.1	9.3	67.5	9.7	88.0	12.0
43	10/25	1,635	3.2	12.8	1.8	8.9	64.3	9.0	87.9	12.1
44	11/1	1,750	2.3	14.2	3.1	10.5	60.0	9.9	87.1	12.9
45	11/8	571	1.6	9.8	2.8	13.5	61.5	10.9	84.9	15.1
46-53	12/31	397	2.5	10.6	3.5	14.1	57.4	11.8	83.4	16.6
Fall total(d):		29,704	1.3	4.9	0.7	11.7	72.3	9.1	86.9	13.1
Spring 2010										
1-9	2/28	ND(e)	ND	ND	ND	ND	ND	ND	ND	ND
10	3/7	110	0.0	9.1	11.8	8.2	53.6	17.3	91.8	8.2
11	3/14	147	0.7	18.4	8.2	7.5	46.3	19.0	91.8	8.2
12	3/21	253	2.0	17.0	4.7	13.8	49.4	13.0	84.2	15.8
13	3/28	435	3.0	9.7	4.1	13.8	51.3	18.2	83.2	16.8
14	4/4	283	1.1	9.5	7.1	14.1	46.6	21.6	84.8	15.2
15	4/11	161	0.0	8.1	6.2	14.9	39.1	31.7	85.1	14.9
16	4/18	140	2.1	3.6	2.9	17.1	49.3	25.0	80.7	19.3
17-27	6/30	89	1.1	1.1	1.1	27.0	51.7	18.0	71.9	28.1
Spring total(d):		1,618	1.6	8.8	4.7	16.4	49.1	19.4	82.1	17.9
Run total(d):		31,322	1.3	5.0	0.8	11.9	71.5	9.4	86.8	13.2

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 trapped fish.

(b) See Appendix Table C-1 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) From Darren Ogden (NMFS, personal communication).

(d) Run total percentages for each fish size and origin class were calculated from escapement estimates in Appendix Table C-4.

(e) ND = no data.

Appendix Table C-4. Estimated weekly escapement, by fish size and origin, of steelhead at Lower Granite Dam (LGD), spawn year 2010. Large fish are greater than or equal to 78 cm (FL) and small fish are less than 78 cm (FL). Clipped and unclipped refer to the adipose fin.

Statistical week(a)	Sample period ending(b)	LGD window count(c)	Estimated number of steelhead at LGD that were:							
			Large wild	Large hatchery clipped	Large hatchery unclipped	Small wild	Small hatchery clipped	Small hatchery unclipped	Total hatchery	Total wild
Fall 2009										
27-30	7/26	3,382	0	0	35	0	2,894	453	3,382	0
31-34	8/23	6,511	0	34	0	1,860	4,100	517	4,651	1,860
35	8/30	2,387	0	0	0	620	1,602	165	1,767	620
36	9/6	15,836	70	47	23	3,032	11,311	1,353	12,734	3,102
37	9/13	38,038	138	163	26	5,417	28,795	3,499	32,483	5,555
38	9/20	49,358	396	497	20	5,784	38,582	4,079	43,178	6,180
39	9/27	36,708	334	717	67	3,785	28,804	3,001	32,589	4,119
40	10/4	39,565	458	1,967	49	4,109	29,467	3,515	34,998	4,567
41	10/11	43,269	716	3,002	321	4,124	30,950	4,156	38,429	4,840
42	10/18	28,744	779	2,793	304	2,672	19,403	2,793	25,293	3,451
43	10/25	18,412	597	2,365	327	1,633	11,835	1,655	16,182	2,230
44	11/1	16,931	397	2,399	522	1,780	10,159	1,674	14,754	2,177
45	11/8	6,246	98	613	175	842	3,840	678	5,306	940
46-53	12/31	7,043	177	745	248	993	4,046	834	5,873	1,170
Fall total:		312,430	4,160	15,342	2,117	36,651	225,788	28,372	271,619	40,811
Spring 2010										
1-9	2/28	ND(d)	ND	ND	ND	ND	ND	ND	ND	ND
10	3/7	619	0	56	73	51	332	107	568	51
11	3/14	665	5	122	54	50	307	127	610	55
12	3/21	1,717	34	292	81	238	848	224	1,445	272
13	3/28	2,321	69	224	96	320	1,190	422	1,932	389
14	4/4	1,505	16	144	106	213	702	324	1,276	229
15	4/11	885	0	71	55	132	347	280	753	132
16	4/18	865	19	31	25	148	426	216	698	167
17-27	6/30	2,375	27	27	27	640	1,227	427	1,708	667
Spring total:		10,952	170	967	517	1,792	5,379	2,127	8,990	1,962
Run total:		323,382	4,330	16,309	2,634	38,443	231,167	30,499	280,609	42,773
95% CI:			(3,926-4,758)	(15,545-17,098)	(2,321-2,964)	(37,224-39,663)	(229,507-232,851)	(29,404-31,628)	(279,318-281,883)	(41,467-44,089)

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 trapped fish.

(b) See Appendix Table C-1 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) Downloaded from COE link 7/10/12.

(d) ND = no data.

Appendix Table C-5. Number of wild adult steelhead scale and genetics samples collected at Lower Granite Dam and subsequently aged or genotyped, spawn year 2010. Large and small fish were combined.

Statistical week(a)	Sampling period 2009-10	Number of days	Wild run size(b)	Number of scale and genetics samples collected	Number of scale and genetics systematic subsamples	Scale samples:		Genetics samples:			
						Number of samples aged(c)	Percent of run aged	Number of samples genotyped for gender(c)	Percent of run genotyped for gender	Number of samples genotyped for stock(c)	Percent of run genotyped for stock
Fall 2009											
27-36(d,e)	7/1-9/6	68	5,582	266	107	101	1.8	104	1.9	107	1.9
37	9/7-9/13	7	5,555	646	286	261	4.7	258	4.6	285	5.1
38	9/14-9/20	7	6,180	609	304	281	4.5	289	4.7	303	4.9
39	9/21-9/27	7	4,119	431	216	196	4.8	212	5.1	215	5.2
40	9/28-10/4	7	4,567	469	234	206	4.5	227	5.0	232	5.1
41	10/5-10/11	7	4,840	453	227	204	4.2	221	4.6	227	4.7
42	10/12-10/18	7	3,451	341	170	155	4.5	164	4.8	169	4.9
43	10/19-10/25	7	2,230	198	99	91	4.1	94	4.2	98	4.4
44	10/26-11/1	7	2,177	225	113	101	4.6	102	4.7	113	5.2
45-53(f)	11/2-12/31	60	2,110	152	76	69	3.3	73	3.5	76	3.6
Fall total:		184	40,811	3,790	1,832	1,665	4.1	1,744	4.3	1,825	4.5
Spring 2010											
1-9(g)	1/1-2/28	59	ND(h)	ND	ND	ND	ND	ND	ND	ND	ND
10-27(d)	3/1-6/30	122	1,962	253	94	82	4.2	85	4.3	90	4.6
Spring total:		181	1,962	253	94	82	4.2	85	4.3	90	4.6
Run total:		365	42,773	4,043	1,926	1,747	4.1	1,829	4.3	1,915	4.5

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 aged or genotyped fish.

(b) From Appendix Table C-4.

(c) Some subsamples were not aged or genotyped due to missing scales or fin clips; other subsamples were not able to be aged (freshwater and saltwater) or successfully genotyped; neither are included here.

(d) Includes partial beginning or ending week.

(e) The trap was closed 7/21 to 8/17 and 9/2 to 9/5 due to high water temperatures.

(f) The trap was closed 11/16 to 12/31 due to freezing water temperatures.

(g) The window and trap were closed 1/1 to 2/28; the fish ladder was closed 1/4 to 2/2 and fish passage was only by navigation lock.

(h) ND = no data.

Appendix Table C-6. Weekly age frequencies, by brood year and age class, of wild adult steelhead sampled at Lower Granite Dam (LGD), spawn year 2010. Large and small fish were combined.

Statistical week(a)	Sample period ending(b)	Number of samples aged	Brood year and age class (frequency):																	
			2007	2006	2006	2005	2005	2005	2005	2004	2004	2004	2004	2003	2003	2003	2003	2002	2002	
			1.1	1.2	2.1	1.3	2.2	3.1	2.1S	2.3	3.2	4.1	2.1S1	3.3	4.2	5.1	3.1S1	3.2S	4.3	4.1S1
Fall 2009																				
27-36	9/6	101	2	1	35	-	13	31	-	1	11	4	-	-	3	-	-	-	-	-
37	9/13	261	5	1	82	-	45	63	-	1	39	11	1	2	10	1	-	-	-	-
38	9/20	281	5	2	93	1	34	81	-	1	33	16	-	6	8	1	-	-	-	-
39	9/27	196	3	2	68	-	34	51	-	1	24	6	-	1	3	1	1	-	-	1
40	10/4	206	3	9	78	-	41	33	1	1	24	6	-	1	6	-	3	-	-	-
41	10/11	204	2	3	61	-	73	27	-	1	26	4	-	1	3	-	2	-	1	-
42	10/18	155	2	6	33	-	53	24	-	6	21	4	1	2	2	-	1	-	-	-
43	10/25	91	-	2	26	-	32	14	-	3	12	-	-	1	1	-	-	-	-	-
44	11/1	101	2	4	27	-	34	12	-	1	17	-	1	2	1	-	-	-	-	-
45-53	12/31	69	4	-	27	-	19	10	-	1	6	-	-	-	1	-	-	1	-	-
Fall total:		1,665	28	30	530	1	378	346	1	17	213	51	3	16	38	3	7	1	1	1
Spring 2010																				
1-9	2/28	ND(c)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10-27	6/30	82	2	2	38	-	11	19	-	1	8	1	-	-	-	-	-	-	-	-
Spring total:		82	2	2	38	0	11	19	0	1	8	1	0	0	0	0	0	0	0	0
Run total:		1,747	30	32	568	1	389	365	1	18	221	52	3	16	38	3	7	1	1	1

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 aged fish.

(b) See Appendix Table C-5 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) ND = no data.

Appendix Table C-7. Weekly age percentages, by brood year and age class, of wild adult steelhead sampled at Lower Granite Dam (LGD), spawn year 2010. Large and small fish were combined. Percentages may not sum to 100.0% due to rounding error.

Statistical week(a)	Sample period ending(b)	Number of samples aged	Brood year and age class (percent):																	
			2007 1.1	2006 1.2	2006 2.1	2005 1.3	2005 2.2	2005 3.1	2005 2.1S	2004 2.3	2004 3.2	2004 4.1	2004 2.1S1	2003 3.3	2003 4.2	2003 5.1	2003 3.1S1	2003 3.2S	2002 4.3	2002 4.1S1
Fall 2009																				
27-36	9/6	101	2.0	1.0	34.7	-	12.9	30.7	-	1.0	10.9	4.0	-	-	3.0	-	-	-	-	-
37	9/13	261	1.9	0.4	31.4	-	17.2	24.1	-	0.4	14.9	4.2	0.4	0.8	3.8	0.4	-	-	-	-
38	9/20	281	1.8	0.7	33.1	0.4	12.1	28.8	-	0.4	11.7	5.7	-	2.1	2.8	0.4	-	-	-	-
39	9/27	196	1.5	1.0	34.7	-	17.3	26.0	-	0.5	12.2	3.1	-	0.5	1.5	0.5	0.5	-	-	0.5
40	10/4	206	1.5	4.4	37.9	-	19.9	16.0	0.5	0.5	11.7	2.9	-	0.5	2.9	-	1.5	-	-	-
41	10/11	204	1.0	1.5	29.9	-	35.8	13.2	-	0.5	12.7	2.0	-	0.5	1.5	-	1.0	-	0.5	-
42	10/18	155	1.3	3.9	21.3	-	34.2	15.5	-	3.9	13.5	2.6	0.6	1.3	1.3	-	0.6	-	-	-
43	10/25	91	-	2.2	28.6	-	35.2	15.4	-	3.3	13.2	-	-	1.1	1.1	-	-	-	-	-
44	11/1	101	2.0	4.0	26.7	-	33.7	11.9	-	1.0	16.8	-	1.0	2.0	1.0	-	-	-	-	-
45-53	12/31	69	5.8	-	39.1	-	27.5	14.5	-	1.4	8.7	-	-	-	1.4	-	-	1.4	-	-
Fall total:		1,665	1.7	1.8	31.8	0.1	22.7	20.8	0.1	1.0	12.8	3.1	0.2	1.0	2.3	0.2	0.4	0.1	0.1	0.1
Spring 2010																				
1-9	2/28	ND(c)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10-27	6/30	82	2.4	2.4	46.3	-	13.4	23.2	-	1.2	9.8	1.2	-	-	-	-	-	-	-	-
Spring total:		82	2.4	2.4	46.3	0.0	13.4	23.2	0.0	1.2	9.8	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Run total:		1,747	1.7	1.8	32.5	0.1	22.3	20.9	0.1	1.0	12.7	3.0	0.2	0.9	2.2	0.2	0.4	0.1	0.1	0.1

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 aged fish.

(b) See Appendix Table C-5 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) ND = no data.

Appendix Table C-8. Weekly gender frequencies of wild adult steelhead sampled at Lower Granite Dam (LGD), spawn year 2010. Large and small fish were combined.

Statistical week(a)	Sample period ending(b)	Number of samples genotyped for gender	Gender (frequency):	
			Female	Male
Fall 2009				
27-36	9/6	104	71	33
37	9/13	258	170	88
38	9/20	289	190	99
39	9/27	212	128	84
40	10/4	227	144	83
41	10/11	221	136	85
42	10/18	164	97	67
43	10/25	94	48	46
44	11/1	102	61	41
45-53	12/31	73	36	37
Fall total:		1,744	1,081	663
Spring 2010				
1-9	2/28	ND(c)	ND	ND
10-27	6/30	85	48	37
Spring total:		85	48	37
Run total:		1,829	1,129	700

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 genotyped fish.

(b) See Appendix Table C-5 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) ND = no data.

Appendix Table C-9. Weekly gender percentages of wild adult steelhead sampled at Lower Granite Dam (LGD), spawn year 2010. Large and small fish were combined. Percentages may not sum to 100.0% due to rounding error.

Statistical week(a)	Sample period ending(b)	Number of samples genotyped for gender	Gender (percent):	
			Female	Male
Fall 2009				
27-36	9/6	104	68.3	31.7
37	9/13	258	65.9	34.1
38	9/20	289	65.7	34.3
39	9/27	212	60.4	39.6
40	10/4	227	63.4	36.6
41	10/11	221	61.5	38.5
42	10/18	164	59.1	40.9
43	10/25	94	51.1	48.9
44	11/1	102	59.8	40.2
45-53	12/31	73	49.3	50.7
Fall total:		1,744	62.0	38.0
Spring 2010				
1-9	2/28	ND(c)	ND	ND
10-27	6/30	85	56.5	43.5
Spring total:		85	56.5	43.5
Run total:		1,829	61.7	38.3

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 genotyped fish.

(b) See Appendix Table C-5 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) ND = no data.

Appendix Table C-10. Frequencies of wild adult steelhead sampled at Lower Granite Dam by gender by age for each genetic stock, spawn year 2010. Large and small fish were combined. Only individual fish whose assignment probability was ≥ 0.80 and had both a determined sex and a total age are included ($n = 824$); fish whose assignment probability was < 0.80 are excluded ($n = 1,091$). See Appendix Table B-1 for stock abbreviations.

Genetic stock	Sex	Brood year and age class (frequency)															Total sample
		2007 1.1	2006 1.2	2006 2.1	2005 2.2	2005 3.1	2004 2.3	2004 3.2	2004 4.1	2004 2.1S1	2003 3.3	2003 4.2	2003 5.1	2003 3.1S1	2003 3.2S	2002 4.1S1	
UPSALM	F	0	1	37	24	16	0	11	1	0	0	0	0	0	1	1	92
	M	2	2	32	5	10	0	2	0	0	0	0	0	0	0	0	53
	Total:	2	3	69	29	26	0	13	1	0	0	0	0	0	1	1	145
MFSALM	F	0	0	8	9	39	1	33	12	0	4	9	0	0	0	0	115
	M	0	0	7	2	13	0	7	7	0	1	2	0	0	0	0	39
	Total:	0	0	15	11	52	1	40	19	0	5	11	0	0	0	0	154
SFSALM	F	0	0	0	3	5	0	15	1	0	3	6	2	0	0	0	35
	M	1	0	2	0	5	0	3	1	0	1	1	0	0	0	0	14
	Total:	1	0	2	3	10	0	18	2	0	4	7	2	0	0	0	49
LOSALM	F	0	0	4	4	1	0	6	0	0	0	0	0	0	0	0	15
	M	0	0	3	1	4	0	0	0	0	0	0	0	0	0	0	8
	Total:	0	0	7	5	5	0	6	0	0	0	0	0	0	0	0	23
UPCLWR	F	1	1	0	19	9	2	26	2	0	0	3	0	0	0	0	63
	M	1	0	4	10	10	1	5	2	0	2	2	0	0	0	0	37
	Total:	2	1	4	29	19	3	31	4	0	2	5	0	0	0	0	100
SFCLWR	F	1	2	1	30	4	2	7	0	0	1	2	0	0	0	0	50
	M	1	0	7	10	6	5	5	0	0	0	0	0	0	0	0	34
	Total:	2	2	8	40	10	7	12	0	0	1	2	0	0	0	0	84
LOCLWR	F	0	0	5	5	1	0	2	0	0	0	0	0	0	0	0	13
	M	1	1	6	2	1	0	0	0	0	0	0	0	0	0	0	11
	Total:	1	1	11	7	2	0	2	0	0	0	0	0	0	0	0	24
IMNAHA	F	0	0	10	6	12	0	3	0	0	0	0	0	1	0	0	32
	M	2	1	5	1	7	0	2	0	0	0	0	0	1	0	0	19
	Total:	2	1	15	7	19	0	5	0	0	0	0	0	2	0	0	51
GRROND	F	0	0	24	23	14	0	8	0	1	0	1	0	2	0	0	73
	M	2	0	25	8	9	0	2	1	0	0	0	0	0	0	0	47
	Total:	2	0	49	31	23	0	10	1	1	0	1	0	2	0	0	120
LSNAKE	F	0	0	10	14	5	0	3	0	0	0	1	0	0	0	0	33
	M	2	0	26	4	7	0	1	0	1	0	0	0	0	0	0	41
	Total:	2	0	36	18	12	0	4	0	1	0	1	0	0	0	0	74
Grand total:		14	8	216	180	178	11	141	27	2	12	27	2	4	1	1	824

Appendix Table C-11. Percentage of wild adult steelhead sampled at Lower Granite Dam by gender by age for each genetic stock, spawn year 2010. Large and small fish were combined. Only individual fish whose assignment probability was ≥ 0.80 and had both a determined sex and a total age are included (n = 824); fish whose assignment probability was < 0.80 are excluded (n = 1,091). See Appendix Table B-1 for stock abbreviations.

Genetic stock	Sex	Brood year and age class (percentage)															Sex ratio
		2007 1.1	2006 1.2	2006 2.1	2005 2.2	2005 3.1	2004 2.3	2004 3.2	2004 4.1	2004 2.1S1	2003 3.3	2003 4.2	2003 5.1	2003 3.1S1	2003 3.2S	2002 4.1S1	
UPSALM	F	0.0	1.1	40.2	26.1	17.4	0.0	12.0	1.1	0.0	0.0	0.0	0.0	0.0	1.1	1.1	63.4
	M	3.8	3.8	60.4	9.4	18.9	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.6
	Total:	1.4	2.1	47.6	20.0	17.9	0.0	9.0	0.7	0.0	0.0	0.0	0.0	0.0	0.7	0.7	100.0
MFSALM	F	0.0	0.0	7.0	7.8	33.9	0.9	28.7	10.4	0.0	3.5	7.8	0.0	0.0	0.0	0.0	74.7
	M	0.0	0.0	17.9	5.1	33.3	0.0	17.9	17.9	0.0	2.6	5.1	0.0	0.0	0.0	0.0	25.3
	Total:	0.0	0.0	9.7	7.1	33.8	0.6	26.0	12.3	0.0	3.2	7.1	0.0	0.0	0.0	0.0	100.0
SFSALM	F	0.0	0.0	0.0	8.6	14.3	0.0	42.9	2.9	0.0	8.6	17.1	5.7	0.0	0.0	0.0	71.4
	M	7.1	0.0	14.3	0.0	35.7	0.0	21.4	7.1	0.0	7.1	7.1	0.0	0.0	0.0	0.0	28.6
	Total:	2.0	0.0	4.1	6.1	20.4	0.0	36.7	4.1	0.0	8.2	14.3	4.1	0.0	0.0	0.0	100.0
LOSALM	F	0.0	0.0	26.7	26.7	6.7	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.2
	M	0.0	0.0	37.5	12.5	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.8
	Total:	0.0	0.0	30.4	21.7	21.7	0.0	26.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
UPCLWR	F	1.6	1.6	0.0	30.2	14.3	3.2	41.3	3.2	0.0	0.0	4.8	0.0	0.0	0.0	0.0	63.0
	M	2.7	0.0	10.8	27.0	27.0	2.7	13.5	5.4	0.0	5.4	5.4	0.0	0.0	0.0	0.0	37.0
	Total:	2.0	1.0	4.0	29.0	19.0	3.0	31.0	4.0	0.0	2.0	5.0	0.0	0.0	0.0	0.0	100.0
SFCLWR	F	2.0	4.0	2.0	60.0	8.0	4.0	14.0	0.0	0.0	2.0	4.0	0.0	0.0	0.0	0.0	59.5
	M	2.9	0.0	20.6	29.4	17.6	14.7	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.5
	Total:	2.4	2.4	9.5	47.6	11.9	8.3	14.3	0.0	0.0	1.2	2.4	0.0	0.0	0.0	0.0	100.0
LOCLWR	F	0.0	0.0	38.5	38.5	7.7	0.0	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2
	M	9.1	9.1	54.5	18.2	9.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.8
	Total:	4.2	4.2	45.8	29.2	8.3	0.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
IMNAHA	F	0.0	0.0	31.3	18.8	37.5	0.0	9.4	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0	62.7
	M	10.5	5.3	26.3	5.3	36.8	0.0	10.5	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	37.3
	Total:	3.9	2.0	29.4	13.7	37.3	0.0	9.8	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	100.0
GRROND	F	0.0	0.0	32.9	31.5	19.2	0.0	11.0	0.0	1.4	0.0	1.4	0.0	2.7	0.0	0.0	60.8
	M	4.3	0.0	53.2	17.0	19.1	0.0	4.3	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.2
	Total:	1.7	0.0	40.8	25.8	19.2	0.0	8.3	0.8	0.8	0.0	0.8	0.0	1.7	0.0	0.0	100.0
LSNAKE	F	0.0	0.0	30.3	42.4	15.2	0.0	9.1	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	44.6
	M	4.9	0.0	63.4	9.8	17.1	0.0	2.4	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	55.4
	Total:	2.7	0.0	48.6	24.3	16.2	0.0	5.4	0.0	1.4	0.0	1.4	0.0	0.0	0.0	0.0	100.0

Appendix Table C-12. Estimated escapement of wild adult steelhead sampled at Lower Granite Dam by gender by age for each genetic stock, spawn year 2010. Large and small fish were combined. Only individual fish whose assignment probability was ≥ 0.80 and had both a determined sex and a total age ($n = 824$) were used; fish whose assignment probability was < 0.80 were excluded ($n = 1,091$). See Appendix Table B-1 for stock abbreviations.

Genetic stock	Sex	Brood year and age class (abundance)															Total abundance
		2007 1.1	2006 1.2	2006 2.1	2005 2.2	2005 3.1	2004 2.3	2004 3.2	2004 4.1	2004 2.1S1	2003 3.3	2003 4.2	2003 5.1	2003 3.1S1	2003 3.2S	2002 4.1S1	
UPSALM	F	0	54	1,987	1,289	859	0	591	54	0	0	0	0	0	54	54	4,942
	M	107	107	1,720	269	537	0	107	0	0	0	0	0	0	0	0	2,847
	Total:	107	161	3,707	1,558	1,396	0	698	54	0	0	0	0	0	54	54	7,789
MFSALM	F	0	0	234	264	1,143	29	967	352	0	117	264	0	0	0	0	3,370
	M	0	0	205	59	381	0	205	205	0	29	59	0	0	0	0	1,143
	Total:	0	0	439	323	1,524	29	1,172	557	0	146	323	0	0	0	0	4,513
SFSALM	F	0	0	0	93	155	0	465	31	0	93	186	62	0	0	0	1,085
	M	31	0	62	0	155	0	93	31	0	31	31	0	0	0	0	434
	Total:	31	0	62	93	310	0	558	62	0	124	217	62	0	0	0	1,519
LOSALM	F	0	0	253	253	63	0	379	0	0	0	0	0	0	0	0	948
	M	0	0	190	63	253	0	0	0	0	0	0	0	0	0	0	506
	Total:	0	0	443	316	316	0	379	0	0	0	0	0	0	0	0	1,454
UPCLWR	F	28	28	0	541	256	57	742	57	0	0	85	0	0	0	0	1,794
	M	28	0	114	285	285	28	143	57	0	57	57	0	0	0	0	1,054
	Total:	56	28	114	826	541	85	885	114	0	57	142	0	0	0	0	2,848
SFCLWR	F	39	77	39	1,154	154	77	270	0	0	39	77	0	0	0	0	1,926
	M	39	0	270	383	231	193	193	0	0	0	0	0	0	0	0	1,309
	Total:	78	77	309	1,537	385	270	463	0	0	39	77	0	0	0	0	3,235
LOCLWR	F	0	0	346	346	69	0	138	0	0	0	0	0	0	0	0	899
	M	69	69	416	138	69	0	0	0	0	0	0	0	0	0	0	761
	Total:	69	69	762	484	138	0	138	0	0	0	0	0	0	0	0	1,660
IMNAHA	F	0	0	578	347	694	0	174	0	0	0	0	0	58	0	0	1,851
	M	116	58	289	58	404	0	116	0	0	0	0	0	58	0	0	1,099
	Total:	116	58	867	405	1,098	0	290	0	0	0	0	0	116	0	0	2,950
GRROND	F	0	0	1,383	1,326	807	0	461	0	58	0	58	0	115	0	0	4,208
	M	115	0	1,441	461	519	0	115	58	0	0	0	0	0	0	0	2,709
	Total:	115	0	2,824	1,787	1,326	0	576	58	58	0	58	0	115	0	0	6,917
LSNAKE	F	0	0	1,336	1,871	668	0	401	0	0	0	134	0	0	0	0	4,410
	M	267	0	3,474	534	935	0	134	0	134	0	0	0	0	0	0	5,478
	Total:	267	0	4,810	2,405	1,603	0	535	0	134	0	134	0	0	0	0	9,888

Appendix D: Wild adult Chinook salmon at Lower Granite Dam, spawn year 2010.

Appendix Table D-1. Weekly window or video counts and adult valid trap samples of Chinook salmon at Lower Granite Dam (LGD), spawn year 2010.

Statistical week(a)	Sampling period 2010	Number of days	LGD window count(b)	LGD adult valid trap sample(c)	LGD adult trap sample rate (%)	Percent of run trapped
10-17	3/1-4/25	56	3,487	129	4-15	3.7
18	4/26-5/2	7	12,810	436	4	3.4
19	5/3-5/9	7	11,140	476	4	4.3
20	5/10-5/16	7	18,149	800	4	4.4
21	5/17-5/23	7	27,222	1,163	4	4.3
22	5/24-5/30	7	11,532	505	4	4.4
23	5/31-6/6	7	4,547	217	4	4.8
24	6/7-6/13	7	1,579	74	4	4.7
25	6/14-6/20	7	18,778	921	4	4.9
26	6/21-6/27	7	9,696	382	4	3.9
27	6/28-7/4	7	7,981	312	4	3.9
28	7/5-7/11	7	4,082	193	4	4.7
29-34(d,e)	7/12-8/17	37	3,681	159	0-4	4.3
Run total:		170	134,684	5,767	0-15	4.3

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 trapped fish.

(b) Downloaded from COE link 7/10/12.

(c) From Darren Ogden (NMFS, personal communication).

(d) Includes partial beginning or ending week.

(e) The trap was closed 8/14 to 8/17 due to high water temperatures.

Appendix Table D-2. Number of Chinook salmon captured in the adult trap, by origin, at Lower Granite Dam (LGD), spawn year 2010. Clipped and unclipped refer to the adipose fin.

Statistical week(a)	Sample period ending(b)	LGD adult valid trap sample(c)	Number of trapped fish that were(c):				
			Wild	Hatchery clipped	Hatchery unclipped	Total hatchery	Total wild
10-17	4/25	129	13	112	4	116	13
18	5/2	436	45	352	39	391	45
19	5/9	476	53	399	24	423	53
20	5/16	800	130	623	47	670	130
21	5/23	1,163	211	866	86	952	211
22	5/30	505	127	353	25	378	127
23	6/6	217	47	157	13	170	47
24	6/13	74	20	51	3	54	20
25	6/20	921	276	625	20	645	276
26	6/27	382	122	251	9	260	122
27	7/4	312	74	227	11	238	74
28	7/11	193	40	149	4	153	40
29-34	8/17	159	47	106	6	112	47
Run total:		5,767	1,205	4,271	291	4,562	1,205

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 trapped fish.

(b) See Appendix Table D-1 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) From Darren Ogden (NMFS, personal communication).

Appendix Table D-3. Percentage of Chinook salmon captured in the adult trap, by origin, at Lower Granite Dam (LGD), spawn year 2010. Clipped and unclipped refer to the adipose fin. Percentages may not sum to 100.0% due to rounding error.

Statistical week(a)	Sample period ending(b)	LGD adult valid trap sample(c)	Percentage of trapped fish that were:				
			Wild	Hatchery clipped	Hatchery unclipped	Total hatchery	Total wild
10-17	4/25	129	10.1	86.8	3.1	89.9	10.1
18	5/2	436	10.3	80.7	8.9	89.7	10.3
19	5/9	476	11.1	83.8	5.0	88.9	11.1
20	5/16	800	16.3	77.9	5.9	83.8	16.3
21	5/23	1,163	18.1	74.5	7.4	81.9	18.1
22	5/30	505	25.1	69.9	5.0	74.9	25.1
23	6/6	217	21.7	72.4	6.0	78.3	21.7
24	6/13	74	27.0	68.9	4.1	73.0	27.0
25	6/20	921	30.0	67.9	2.2	70.0	30.0
26	6/27	382	31.9	65.7	2.4	68.1	31.9
27	7/4	312	23.7	72.8	3.5	76.3	23.7
28	7/11	193	20.7	77.2	2.1	79.3	20.7
29-34	8/17	159	29.6	66.7	3.8	70.4	29.6
Run total(d):		5,767	20.5	74.3	5.2	79.5	20.5

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 trapped fish.

(b) See Appendix Table D-1 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) From Darren Ogden (NMFS, personal communication).

(d) Run total percentages for each origin class were calculated from escapement estimates in Appendix Table D-4.

Appendix Table D-4. Estimated weekly escapement, by origin, of Chinook salmon at Lower Granite Dam (LGD), spawn year 2010. Clipped and unclipped refer to the adipose fin.

Statistical week(a)	Sample period ending(b)	LGD window count(c)	Estimated number of Chinook salmon at LGD that were:				
			Wild	Hatchery clipped	Hatchery unclipped	Total hatchery	Total wild
10-17	4/25	3,487	351	3,028	108	3,136	351
18	5/2	12,810	1,322	10,342	1,146	11,488	1,322
19	5/9	11,140	1,240	9,338	562	9,900	1,240
20	5/16	18,149	2,949	14,134	1,066	15,200	2,949
21	5/23	27,222	4,939	20,270	2,013	22,283	4,939
22	5/30	11,532	2,900	8,061	571	8,632	2,900
23	6/6	4,547	985	3,290	272	3,562	985
24	6/13	1,579	427	1,088	64	1,152	427
25	6/20	18,778	5,627	12,743	408	13,151	5,627
26	6/27	9,696	3,097	6,371	228	6,599	3,097
27	7/4	7,981	1,893	5,807	281	6,088	1,893
28	7/11	4,082	846	3,151	85	3,236	846
29-34	8/17	3,681	1,088	2,454	139	2,593	1,088
Run total:		134,684	27,664	100,077	6,943	107,020	27,664
95% CI:			(26,304-29,099)	(98,579-101,564)	(6,215-7,734)	(105,663-108,366)	(26,304-29,099)

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 trapped fish.

(b) See Appendix Table D-1 for inclusive dates and other notes regarding statistical weeks and LGD operations.

(c) Downloaded from COE link 7/10/12.

Appendix Table D-5. Number of wild adult Chinook salmon scale and genetics samples collected at Lower Granite Dam and subsequently aged or genotyped, spawn year 2010.

Statistical week(a)	Sampling period 2010	Number of days	Wild run size(b)	Number of scale and genetics samples collected	Number of scale and genetics systematic subsamples	Scale samples:		Genetics samples:			
						Number of samples aged(c)	Percent of run aged	Number of samples genotyped for gender(c)	Percent of run genotyped for gender	Number of samples genotyped for stock(c)	Percent of run genotyped for stock
10-19	3/1-5/9	70	2,913	111	111	104	3.6	105	3.6	109	3.7
20	5/10-5/16	7	2,949	130	130	130	4.4	121	4.1	126	4.3
21	5/17-5/23	7	4,939	211	211	205	4.2	195	3.9	204	4.1
22-24	5/24-6/13	21	4,312	194	193	185	4.3	184	4.3	192	4.5
25	6/14-6/20	7	5,627	276	266	256	4.5	260	4.6	264	4.7
26	6/21-6/27	7	3,097	122	122	117	3.8	117	3.8	122	3.9
27-34(d,e)	6/28-8/17	51	3,827	161	161	154	4.0	151	3.9	159	4.2
Run total:		170	27,664	1,205	1,194	1,151	4.2	1,133	4.1	1,176	4.3

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 aged or genotyped fish.

(b) From Appendix Table D-4.

(c) Some subsamples were not aged or genotyped due to missing scales or fin clips; other subsamples were not able to be aged (freshwater and saltwater) or successfully genotyped; neither are included here.

(d) Includes partial beginning or ending week.

(e) The trap was closed 8/14 to 8/17 due to high water temperatures.

Appendix Table D-6. Weekly age frequencies, by brood year and age class, of wild adult Chinook salmon sampled at Lower Granite Dam (LGD), spawn year 2010.

Statistical week(a)	Sample period ending(b)	Number of samples aged	Brood year and age class (frequency):								
			2008 0.1	2008 1.0	2007 0.2	2007 1.1	2006 0.3	2006 1.2	2006 2.1	2005 1.3	2005 2.2
10-19	5/9	104	1	-	-	-	-	90	-	10	3
20	5/16	130	-	-	-	1	-	121	-	8	-
21	5/23	205	-	-	1	5	-	191	-	5	3
22-24	6/13	185	-	-	-	11	-	161	1	12	-
25	6/20	256	-	-	-	10	-	231	-	13	2
26	6/27	117	-	-	-	8	-	104	-	4	1
27-34	8/17	154	-	1	-	17	1	112	3	4	16
Run total:		1,151	1	1	1	52	1	1,010	4	56	25

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 aged fish.

(b) See Appendix Table D-5 for inclusive dates and other notes regarding statistical weeks and LGD operations.

Appendix Table D-7. Weekly age percentages, by brood year and age class, of wild adult Chinook salmon sampled at Lower Granite Dam (LGD), spawn year 2010. Percentages may not sum to 100.0% due to rounding error.

Statistical week(a)	Sample period ending(b)	Number of samples aged	Brood year and age class (percent):								2005 1.3	2005 2.2
			2008 0.1	2008 1.0	2007 0.2	2007 1.1	2006 0.3	2006 1.2	2006 2.1			
10-19	5/9	104	1.0	-	-	-	-	86.5	-	9.6	2.9	
20	5/16	130	-	-	-	0.8	-	93.1	-	6.2	-	
21	5/23	205	-	-	0.5	2.4	-	93.2	-	2.4	1.5	
22-24	6/13	185	-	-	-	5.9	-	87.0	0.5	6.5	-	
25	6/20	256	-	-	-	3.9	-	90.2	-	5.1	0.8	
26	6/27	117	-	-	-	6.8	-	88.9	-	3.4	0.9	
27-34	8/17	154	-	0.6	-	11.0	0.6	72.7	1.9	2.6	10.4	
Run total:		1,151	0.1	0.1	0.1	4.5	0.1	87.7	0.3	4.9	2.2	

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 aged fish.

(b) See Appendix Table D-5 for inclusive dates and other notes regarding statistical weeks and LGD operations.

Appendix Table D-8. Weekly gender frequencies of wild adult Chinook salmon sampled at Lower Granite Dam (LGD), spawn year 2010.

Statistical week(a)	Sample period ending(b)	Number of samples genotyped for gender	Gender (frequency):	
			Female	Male
10-19	5/9	105	59	46
20	5/16	121	47	74
21	5/23	195	81	114
22-24	6/13	184	92	92
25	6/20	260	111	149
26	6/27	117	43	74
27-34	8/17	151	64	87
Run total:		1,133	497	636

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 genotyped fish.

(b) See Appendix Table D-5 for inclusive dates and other notes regarding statistical weeks and LGD operations.

Appendix Table D-9. Weekly gender percentages of wild adult Chinook salmon sampled at Lower Granite Dam (LGD), spawn year 2010. Percentages may not sum to 100.0% due to rounding error.

Statistical week(a)	Sample period ending(b)	Number of samples genotyped for gender	Gender (percent):	
			Female	Male
10-19	5/9	105	56.2	43.8
20	5/16	121	38.8	61.2
21	5/23	195	41.5	58.5
22-24	6/13	184	50.0	50.0
25	6/20	260	42.7	57.3
26	6/27	117	36.8	63.2
27-34	8/17	151	42.4	57.6
Run total:		1,133	43.9	56.1

(a) Statistical weeks were grouped to try to provide a minimum sample size of 100 genotyped fish.

(b) See Appendix Table D-5 for inclusive dates and other notes regarding statistical weeks and LGD operations.

Appendix Table D-10. Frequencies of wild adult Chinook salmon sampled at Lower Granite Dam by gender by age for each genetic stock, spawn year 2010. Only individual fish whose assignment probability was ≥ 0.80 and had both a determined sex and a total age are included ($n = 511$); fish whose assignment probability was < 0.80 are excluded ($n = 665$). See Appendix Table B-2 for stock abbreviations.

Genetic stock	Sex	Brood year and age class (frequency)								Total sample
		2008 1.0	2007 0.2	2007 1.1	2006 0.3	2006 1.2	2006 2.1	2005 1.3	2005 2.2	
UPSALM	F	0	0	0	0	26	0	8	0	34
	M	0	0	1	0	47	1	5	0	54
	Total:	0	0	1	0	73	1	13	0	88
MFSALM	F	0	0	1	0	32	0	3	0	36
	M	0	0	2	0	53	0	1	0	56
	Total:	0	0	3	0	85	0	4	0	92
CHMBLN	F	0	0	0	0	14	0	0	0	14
	M	0	0	0	0	12	0	0	0	12
	Total:	0	0	0	0	26	0	0	0	26
SFSALM	F	0	0	0	0	26	0	0	0	26
	M	0	0	0	0	25	0	0	0	25
	Total:	0	0	0	0	51	0	0	0	51
HELLSC	F	0	0	0	0	100	0	8	1	109
	M	0	0	12	0	96	0	1	2	111
	Total:	0	0	12	0	196	0	9	3	220
TUCANO	F	0	0	0	0	0	0	1	0	1
	M	0	0	0	0	2	0	0	0	2
	Total:	0	0	0	0	2	0	1	0	3
FALL	F	0	0	0	1	3	0	2	6	12
	M	1	1	1	0	4	3	0	9	19
	Total:	1	1	1	1	7	3	2	15	31
Grand total:		1	1	17	1	440	4	29	18	511

Appendix Table D-11. Percentage of wild adult Chinook salmon sampled at Lower Granite Dam by gender by age for each genetic stock, spawn year 2010. Only individual fish whose assignment probability was ≥ 0.80 and had both a determined sex and a total age are included (n = 511); fish whose assignment probability was < 0.80 are excluded (n = 665). See Appendix Table B-2 for stock abbreviations.

Genetic stock	Sex	Brood year and age class (percentage)								Sex ratio
		2008 1.0	2007 0.2	2007 1.1	2006 0.3	2006 1.2	2006 2.1	2005 1.3	2005 2.2	
UPSALM	F	0.0	0.0	0.0	0.0	76.5	0.0	23.5	0.0	38.6
	M	0.0	0.0	1.9	0.0	87.0	1.9	9.3	0.0	61.4
	Total:	0.0	0.0	1.1	0.0	83.0	1.1	14.8	0.0	100.0
MFSALM	F	0.0	0.0	2.8	0.0	88.9	0.0	8.3	0.0	39.1
	M	0.0	0.0	3.6	0.0	94.6	0.0	1.8	0.0	60.9
	Total:	0.0	0.0	3.3	0.0	92.4	0.0	4.3	0.0	100.0
CHMBLN	F	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	53.8
	M	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	46.2
	Total:	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0
SFSALM	F	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	51.0
	M	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	49.0
	Total:	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0
HELLSC	F	0.0	0.0	0.0	0.0	91.7	0.0	7.3	0.9	49.5
	M	0.0	0.0	10.8	0.0	86.5	0.0	0.9	1.8	50.5
	Total:	0.0	0.0	5.5	0.0	89.1	0.0	4.1	1.4	100.0
TUCANO	F	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	33.3
	M	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	66.7
	Total:	0.0	0.0	0.0	0.0	66.7	0.0	33.3	0.0	100.0
FALL	F	0.0	0.0	0.0	8.3	25.0	0.0	16.7	50.0	38.7
	M	5.3	5.3	5.3	0.0	21.1	15.8	0.0	47.4	61.3
	Total:	3.2	3.2	3.2	3.2	22.6	9.7	6.5	48.4	100.0

Appendix Table D-12. Estimated escapement of wild adult Chinook salmon sampled at Lower Granite Dam by gender by age for each genetic stock, spawn year 2010. Only individual fish whose assignment probability was ≥ 0.80 and had both a determined sex and a total age ($n = 511$) were used; fish whose assignment probability was < 0.80 were excluded ($n = 665$). See Appendix Table B-2 for stock abbreviations.

Genetic stock	Sex	Brood year and age class (abundance)								Total abundance
		2008 1.0	2007 0.2	2007 1.1	2006 0.3	2006 1.2	2006 2.1	2005 1.3	2005 2.2	
UPSALM	F	0	0	0	0	1,373	0	423	0	1,796
	M	0	0	53	0	2,483	53	264	0	2,853
	Total:	0	0	53	0	3,856	53	687	0	4,649
MFSALM	F	0	0	49	0	1,574	0	148	0	1,771
	M	0	0	98	0	2,609	0	49	0	2,756
	Total:	0	0	147	0	4,183	0	197	0	4,527
CHMBLN	F	0	0	0	0	621	0	0	0	621
	M	0	0	0	0	533	0	0	0	533
	Total:	0	0	0	0	1,154	0	0	0	1,154
SFSALM	F	0	0	0	0	3,935	0	0	0	3,935
	M	0	0	0	0	3,783	0	0	0	3,783
	Total:	0	0	0	0	7,718	0	0	0	7,718
HELLSC	F	0	0	0	0	3,995	0	320	40	4,355
	M	0	0	479	0	3,836	0	40	80	4,435
	Total:	0	0	479	0	7,831	0	360	120	8,790
TUCANO	F	0	0	0	0	0	0	17	0	17
	M	0	0	0	0	33	0	0	0	33
	Total:	0	0	0	0	33	0	17	0	50
FALL	F	0	0	0	25	75	0	50	150	300
	M	25	25	25	0	101	75	0	225	476
	Total:	25	25	25	25	176	75	50	375	776

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